Report of the Medical Officer of Health / Municipality of Colombo.

MUNICIPALITY OF COLOMBO.

REPORT

OF THE

MEDICAL OFFICER OF HEALTH,

FOR THE YEAR

1922.

PRINTED AT THE MUNICIPAL PRINTING OFFICE, COLOMBO.

REPORT OF THE MEDICAL OFFICER OF HEALTH FOR 1922.

I HAVE the honour to forward the Report on the Vital Statistics of Colombo and the administration of the Public Health Department during the year 1922.

CONTENTS.

INTRODUCTION.

The health of the town was, on the whole, satisfactory, the death-rate, corrected for deaths of non-residents which occurred in the hospitals, being 28·8 per 1,000, which is the same as in the previous year; but for the fact that influenza showed marked signs of recrudescence and caused an increased mortality from pneumonia and other diseases, the general death-rate would undoubtedly have been one of the lowest on record. There was a decrease in the mortality from practically all the preventible diseases including enteric fever, dysentery, diarrhœa, phthisis, and plague.

The question of autochthonous or locally acquired malaria was investigated at considerable length during the year, as there was an impression abroad, which appeared at first sight to be supported by the hospital records and the experience of medical practitioners, that this disease was being acquired to a large extent within the town. This was, however, found upon investigation to be erroneous. There was, it is true, a marked increase of cases under treatment in the town; but with the exception of a comparatively small number of sporadic cases, these were found to have been infected in other parts of the Island where malaria was unusually prevalent. This conclusion is supported by the evidence of Mr. Carter, the Government Malariologist, who, as the result of an extensive investigation including the spleen examination of 3,468 children within the town, has recorded his opinion that "Colombo, and in fact the greater part of the Western Province, must be considered remarkably free from Malaria." He found the spleen rate within the Municipality to be only 0·69 per cent. which is practically negligible. In this connection attention must unfortunately be drawn to a sensational, misleading, and incorrect leading article which appeared recently in Vol. XIX., Part III., of the Journal of the Ceylon Branch of the British Medical Association, which being the journal of an association of medical men, cannot be permitted to remain on record unrebutted.

In connection with plague, attention is invited to the very interesting report submitted by Dr. Hirst, the Municipal Bacteriologist, in which he records the results of his brilliant research work during the year.

In compliance with the Chairman's instructions, a brief description of the organization and method of administration of all branches of the Public Health Department is included in this year's report.

Part I.—General.

1.—METEOROLOGY.

Temperature.—The mean temperature for the year was 80·7° F., as against the average for the previous fifteen years of 80·8°. The monthly mean temperature ranged from a minimum of 78·0° in December to a maximum of 82·8° in April. It fell below 80°, *i.e.*, the critical temperature for plague, during the months of February, November, and December, the temperature during the last two of these months being unusually favourable to plague.

(1) *Statistics.*

(Supplied by the Superintendent of the Colombo Observatory.)

(*a*) Average Monthly Mean Temperature at Colombo Observatory (Cinnamon Gardens). 15 Years.

	°
January ...	79·0
February ...	79·8
March ...	81·4
April ...	82·6
May ...	82·6
June ...	81·7
July ...	81·1
August ...	81·0
September ...	81·0
October ...	80·2
November ...	79·6
December ...	79·0
Year ...	80·8

(*b*) Monthly Mean Temperature at Colombo Observatory during 1922.

	°
January ...	80·0
February ...	79·8
March ...	81·6
April ...	82·8
May ...	82·2
June ...	82·0
July ...	80·4
August ...	81·2
September ...	81·2
October ...	80·2
November ...	79·2
December ...	78·0
Year ...	80·7

(*c*) Average Monthly Rainfall at Colombo Observatory (Cinnamon Gardens). 15 Years.

	Inches.
January ...	3·33
February ...	1·84
March ...	4·14
April ...	7·80
May ...	12·94
June ...	7·77
July ...	5·58
August ...	2·59
September ...	4·73
October ...	12·98
November ...	11·24
December ...	4·57
Year ...	79·51

(*d*) Monthly Rainfall at Colombo Observatory (Cinnamon Gardens) and Colombo Fort during 1922. (Observatory Gauge 25 Feet and Fort 70 Feet above mean Sea Level).

	Colombo Observatory. Inches.	Colombo Fort. Inches.
January ...	2·12	1·92
February ...	2·12	0·54
March ...	1·63	1·87
April ...	8·30	6·83
May ...	22·66	13·75
June ...	9·86	7·74
July ...	2·71	2·56
August ...	1·11	0·72
September	1·36	0·94
October ...	10·92	7·94
November	21·47	19·43
December	3·56	4·09
Year	87·82	68·33

(*e*) Average Monthly Mean Humidity at Colombo Observatory (Cinnamon Gardens). 14 Years.

	Per Cent.
January ...	76
February ...	76
March ...	78
April ...	79
May ...	81
June ...	81
July ...	80
August ...	80
September ...	79
October ...	82
November ...	82
December ...	79
Year ...	79

(*f*) Monthly Mean Humidity at Colombo Observatory during 1922.

	Per Cent.
January ...	74
February ...	78
March ...	80
April ...	78
May ...	80
June ...	81
July ...	82
August ...	80
September ...	80
October ...	82
November ...	83
December ...	76
Year ...	80

With reference to the rainfall at Fort, it should be noted that this gauge is not only higher above sea level, but higher above adjacent ground level, and for this its readings might be expected to be less than those of a gauge at or near ground level. The difference between it and the readings at the Observatory is thus not purely a climatic one, but largely a matter of the exposure of the two gauges.

The Observatory gauge should be taken as the standard.

The humidity in tables (*e*) and (*f*) is the mean of the humidities derived from the maximum, both dry and wet, and the minimum dry and wet.

Rainfall.—The total rainfall for the year at Colombo Observatory was 87·82 inches, as against the average during the previous fifteen years of 79·51 inches. The monthly rainfall varied from a minimum of 1·11 inches in August, to a maximum of 22·66 inches in May, of which no less than 14·88 inches fell during the five days May 9 to 13.

2.—Population.

The estimated mean population during the year was 247,670, but as explained in section 2 of the report for 1921, there is reason to believe that this estimate is considerably below the actual population, which is probably not far short of 300,000.

(2) *Population by Race.*

Race.	Population enumerated at the Census of March 18, 1921.	Population estimated to middle of 1922.
All Races	244,163 ...	247,670
Europeans	2,836 ...	2,877
Burghers	14,863 ...	15,076
Sinhalese	114,600 ...	116,246
Tamils	54,153 ...	54,931
Moors	39,692 ...	40,262
Malays	5,852 ...	5,936
Others	12,167 ...	12,342

Chart, I.

BIRTH-RATE 1903-1922

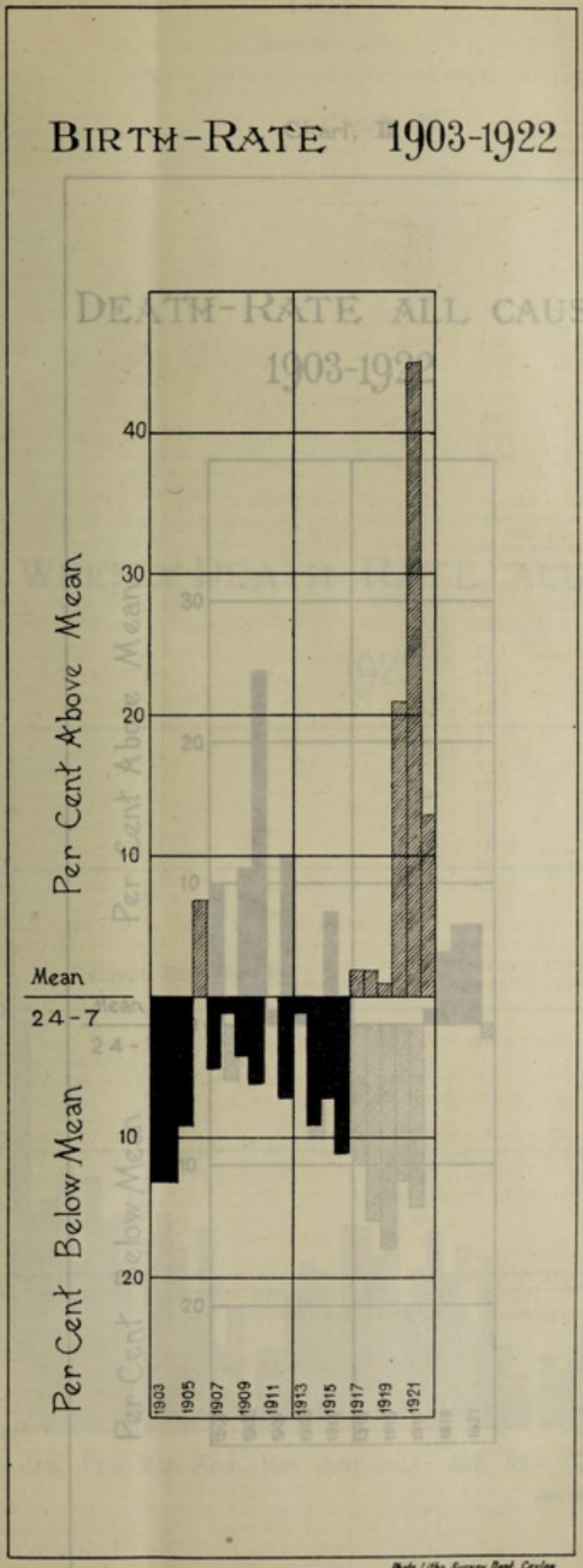

Photo Litho Survey Dept, Ceylon.
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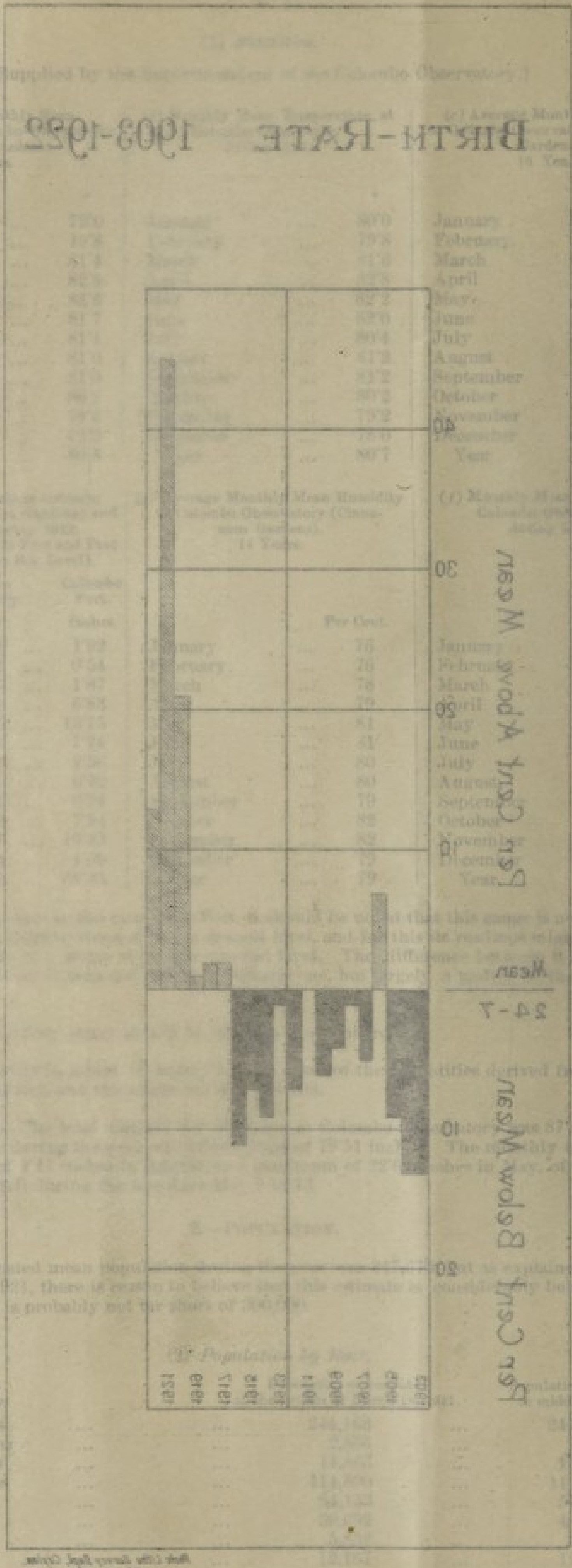
Chart I.



BIRTH-RATE 1903-1922
40
30
20
10
Per Cent Above Mean
Mean
24.7
10
20
Per Cent Below Mean
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922

Chart, II.

DEATH-RATE ALL CAUSES
1903-1922

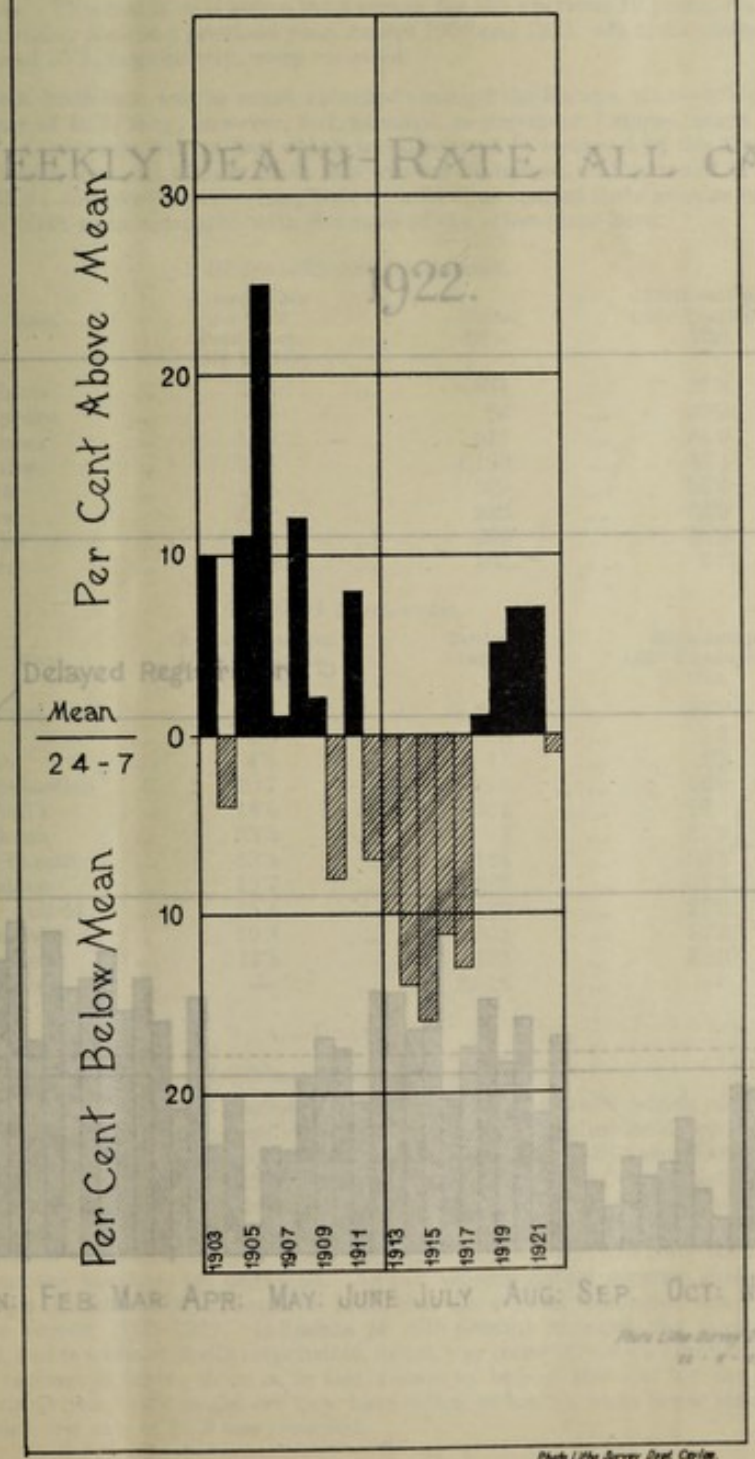


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Chart II

DEATH-RATE ALL CAUSES
1903-1922

Chart, III

WEEKLY DEATH-RATE ALL CAUSES

1922.

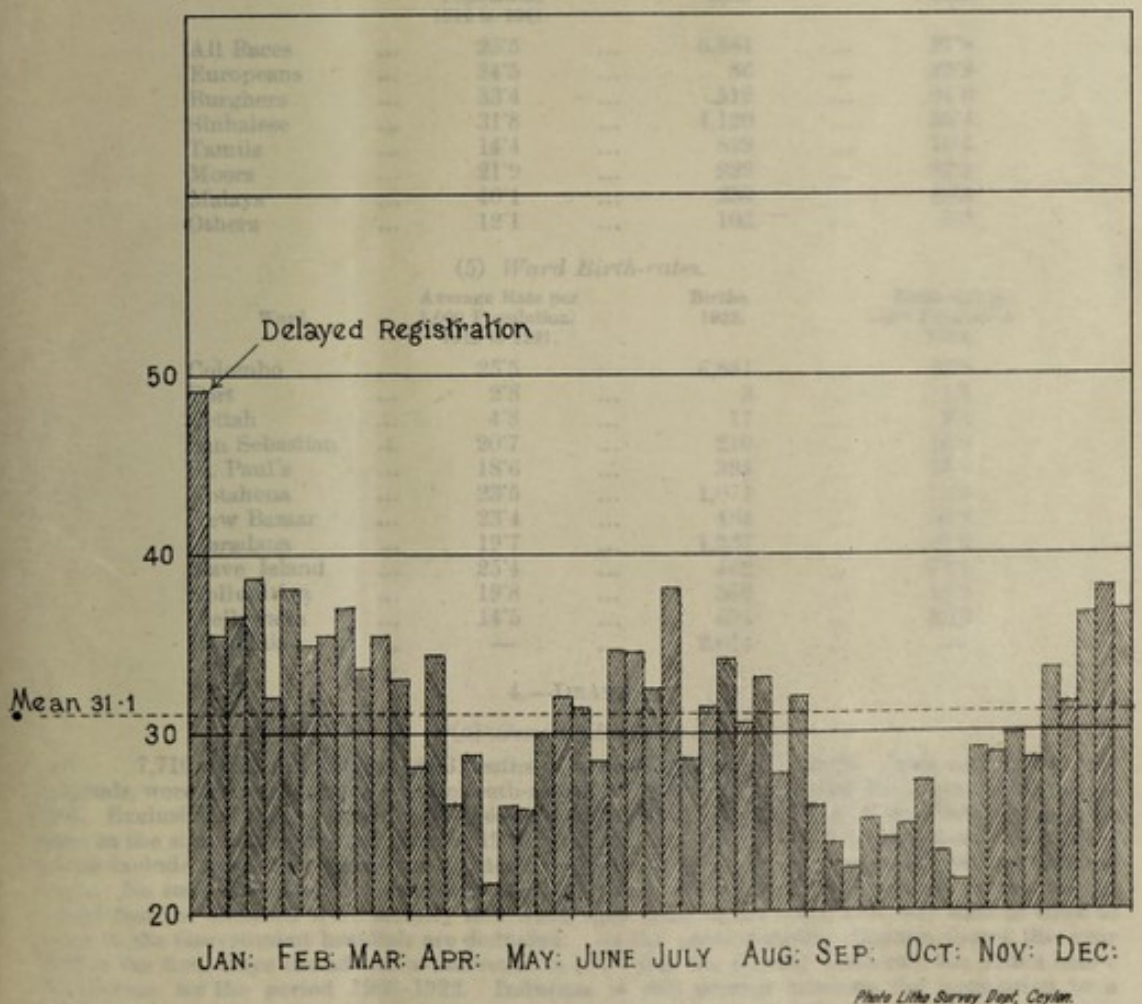

Photo Litho Survey Dept, Ceylon.
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Chart III

WEEKLY DEATH-RATE ALL CAUSES

1922.

(3) *Area and Estimated Population by Wards, 1922.*

Ward.	Total Area in Acres.	Estimated Population.	Density per Acre.
Fort ...	237 ...	2,729 ...	11·5
Pettah ...	129 ...	7,711 ...	59·7
San Sebastian ...	121 ...	11,657 ...	96·4
St. Paul's ...	157 ...	23,731 ...	151·0
Kotahena ...	1,716 ...	46,834 ...	27·3
New Bazaar ...	289 ...	23,676 ...	81·8
Maradana ...	1,773 ...	58,354 ...	32·8
Slave Island ...	322 ...	21,874 ...	67·9
Kollupitiya ...	1,465 ...	24,093 ...	16·4
Wellawatta ...	2,061 ...	27,011 ...	13·1
The Lake ...	317 ...	— ...	—
Colombo Town ...	8,587	247,670	28·8

3.—Births.

6,881 births were registered during the year, giving a birth-rate of 27·8 per 1,000 of estimated population. This rate is well above the average for the previous 10 years, viz.:—25·5 per 1,000, and is in fact higher than any previous year, except 1920 and 1921, when the abnormally high birth-rates of 29·8 and 35·7, respectively, were recorded.

The highest birth-rate was, as usual, recorded amongst the Malays, viz.:—40·3 per 1,000, as against their average of 40·1; they, however, had, as usual, as statement 7 shows, much the highest general death-rate of any race here, a fact which was discussed in section 4 of the Annual Report for 1921. The race with the next highest birth-rate was the Sinhalese, with a rate of 35·4, as against their average of 31·8; followed by the Burghers with 34·0, as against their average of 33·4. All these are very high birth-rates compared with the rates of the other races here.

(4) *Births—Racial Birth-rates.*

Race.	Average Rate per 1,000 Population, 1912 to 1921.	Births, 1922.	Birth-rate per 1,000 Population, 1922.
All Races ...	25·5 ...	6,881 ...	27·8
Europeans ...	24·5 ...	86 ...	29·9
Burghers ...	33·4 ...	512 ...	34·0
Sinhalese ...	31·8 ...	4,120 ...	35·4
Tamils ...	14·4 ...	899 ...	16·4
Moors ...	21·9 ...	922 ...	22·9
Malays ...	40·1 ...	239 ...	40·3
Others ...	12·1 ...	103 ...	8·3

(5) *Ward Birth-rates.*

Ward.	Average Rate per 1,000 Population, 1912 to 1921.	Births, 1922.	Birth-rate per 1,000 Population, 1922.
Colombo ...	25·5 ...	6,881 ...	27·8
Fort ...	2·8 ...	3 ...	1·1
Pettah ...	4·8 ...	17 ...	2·2
San Sebastian ...	20·7 ...	210 ...	18·0
St. Paul's ...	18·6 ...	394 ...	16·6
Kotahena ...	23·5 ...	1,071 ...	22·9
New Bazaar ...	23·4 ...	484 ...	20·4
Maradana ...	19·7 ...	1,237 ...	21·2
Slave Island ...	25·4 ...	462 ...	21·6
Kollupitiya ...	19·8 ...	368 ...	15·3
Wellawatta ...	14·5 ...	621 ...	23·0
Hospitals ...	— ...	2,014 ...	—

4.—Deaths.

(a) *General Death-rate.*

7,710 deaths, including 1,803 deaths of non-residents of the town, which occurred in the hospitals, were recorded, giving a crude death-rate of 31·1 per 1,000, as against the decennial average of 29·6. Exclusive of these deaths of non-residents, the rate for the year was 28·8 per 1,000, which is the same as the similarly corrected rate for 1921. In this connection it may be mentioned that some towns exclude from their death-rate all deaths of persons who are not permanent residents of the town. No such deduction is, however, made in the case of the Colombo death-rate, unless it is on record that the deceased were actually sick when they came to the town, and only such of these as occur in the Government hospitals are deducted. As the accompanying diagram shows, the year 1922 is the first, since the advent of influenza in 1918, that the general death-rate has fallen below the average for the period 1903–1922. Influenza is still present amongst the population to a considerable extent, and is without doubt responsible, directly or indirectly, for a much larger number of deaths than the returns indicate; there is, in fact, reason to believe that but for the presence of this disease, the general death-rate might ere now have fallen as low or even lower than it was in 1915 when the record low rate of 26·3 was recorded.

(*b*) *Ward Death-rates.*

As the statement below shows, the wards with the highest corrected death-rates were New Bazaar (33·2), San Sebastian (31·3), St. Paul's (29·4), and Slave Island (29·0), which are also the wards with the highest densities of population and the highest average death-rates. Exclusive of the comparatively non-residential Fort and Pettah wards, the wards with the lowest death-rates were Wellawatta (16·4) and Kollupitiya (17·3), both of which have far lower densities of population and include a much greater proportion of the houses of the better classes than any other ward in the town.

(6) *Colombo Ward Death-rates (all Causes) in 1922. Death-rate per 1,000 Population.*

Ward.	Average Crude Death-rate, 1912 to 1921.	Deaths, 1922.	Death-rate (Crude), 1922.	Death-rate (corrected for Deaths in Hospitals), 1922.	Death-rate (corrected for Deaths in Hospitals), 1921.	Increase or Decrease, 1922, as compared with 1921.
Colombo	29·6	7,710*	31·1	26·8	28·8	—2·0
Fort	13·3	20	7·3	11·4	13·4	—2·0
Pettah	9·9	63	8·2	17·1	22·9	—5·8
San Sebastian	23·1	291	25·0	31·3	28·7	+2·6
St. Paul's	25·0	585	24·7	29·4	33·1	—3·7
Kotahena	22·6	1,098	23·4	28·4	28·4	0
New Bazaar	26·1	622	26·3	33·2	37·7	—4·5
Maradana	20·5	1,076	18·4	25·7	28·6	—2·9
Slave Island	25·1	524	24·0	29·0	33·7	—4·7
Kollupitiya	19·0	352	14·6	17·3	18·9	—1·6
Wellawatta	9·8	346	12·8	16·4	17·7	—1·3
Hospitals	—	2,733	—	—	—	—

* Inclusive of 1,803 deaths of non-residents of the town.

(*c*) *Race Death-rates.*

As usual, the death-rate amongst the Malays (38·4 per 1,000) far exceeded that for any other race, a fact which was discussed in section 4 of the report for 1921. The very low recorded European death-rate of 8·0 per 1,000 is obviously fallacious, owing to the fact that practically every European who can so afford and who is not too ill to travel, goes home to Europe when he is mortally ill, and dies there. Although the Europeans in Colombo, as a class, live under better sanitary conditions than any other race, the tropical climate of Colombo is not, and never can be really suited to them as well as it is to the indigenous population, nor as well as a temperate climate would be. It would be difficult, if not impossible, to get reliable statistics on the point, but, as the result of long residence and observation here, I am convinced that prolonged residence in the low-country, especially in the wet zone, has a very powerful effect in sapping the vitality and shortening the expectation of life of the average European. If statistics could be obtained, I feel sure they would show that only a tragically small proportion of the total Europeans in the public services of Ceylon live to enjoy pensions for more than five years, and I regard it as a most oppressive and unsound regulation which fixes the minimum age for voluntary retirement at fifty-five instead of fifty years of age. No man who has served twenty years in the low-country should, in my opinion, be compelled against his will to stay on in the tropics after he has reached the age of fifty. The fact that there may be, and no doubt are, a few individuals here and there who find that a tropical climate suits them better than their native European climate, does not affect the general question.

(7) *Colombo Racial Death-rates (all Causes) in 1922. Death-rate per 1,000 Population.*

Race.	Average Crude Death-rate 1912 to 1921.	Deaths, 1922.	Crude Death-rate, 1922.	Rate corrected for Deaths in Institutions.	Increase or Decrease on the Average (Crude).	Decrease due to correction for Institutions.	Rate further corrected for Age and Sex 1922.
All Races	29·6	7,710	31·1	26·8	+ 1·5	4·3	30·2
Europeans	18·2	34	11·8	8·0	— 6·4	3·8	
Burghers	23·6	318	21·1	20·4	— 2·5	·7	
Sinhalese	32·6	4,124	35·5	27·4	+ 2·9	8·1	
Tamils	26·8	1,533	27·9	26·4	+ 1·1	1·5	
Moors	27·9	1,196	29·7	29·3	+ 1·8	·4	
Malays	35·0	229	38·6	38·4	+ 3·6	·2	
Others	28·0	276	22·4	20·5	— 5·6	1·9	

5.—Principal Causes of Deaths.

The following diseases show an increased mortality compared with the previous year, viz.:—

Influenza, pneumonia, bronchitis, and remittent fever.

The following show a decreased mortality, viz.:—

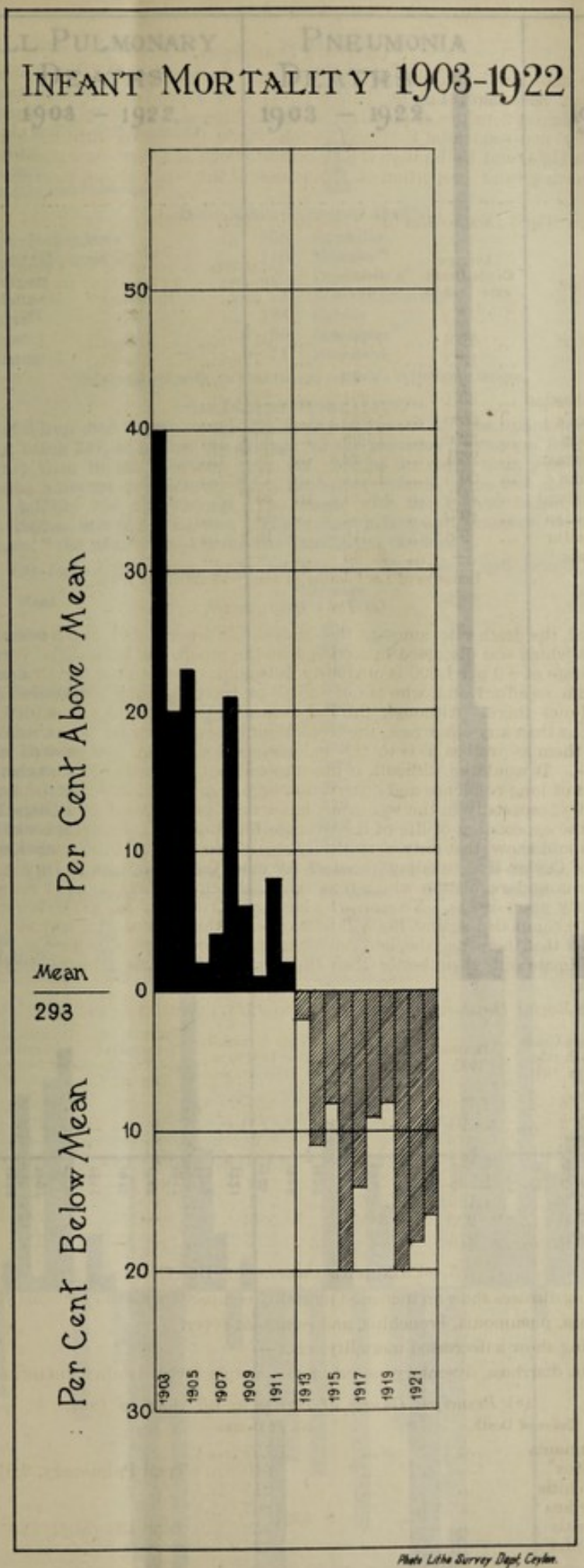
Phthisis, diarrhœa, dysentery, enteric fever, simple fever, debility, infantile convulsions.

(8) *Principal Causes of Deaths at all Ages in 1922.*

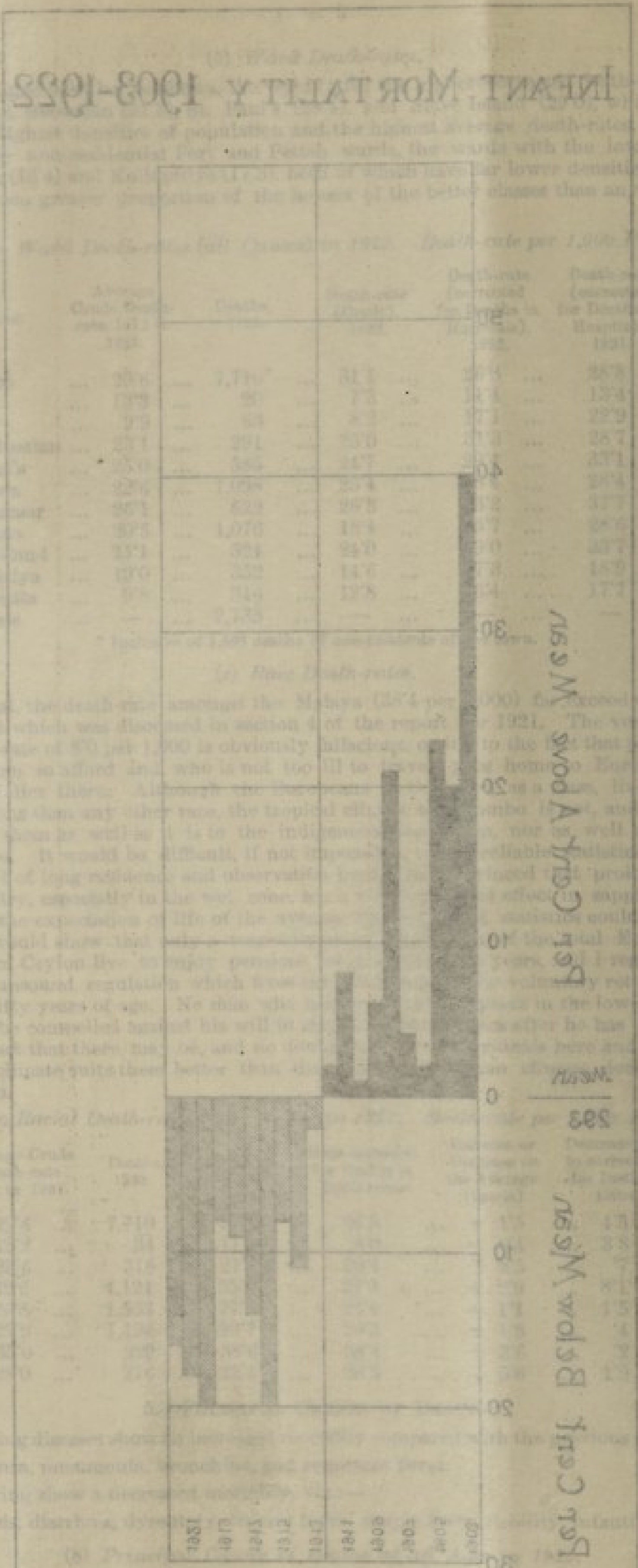
Cause of Death.	No. of Deaths.		
Pneumonia	1,159		
Phthisis*	640		Total Pulmonary, 2,014.
Bronchitis	215		
Diarrhœa	203	539	Total Diarrhœal, 722.
Enteritis	336		
Dysentery	183		

* Those marked with an asterisk are notifiable infectious diseases.

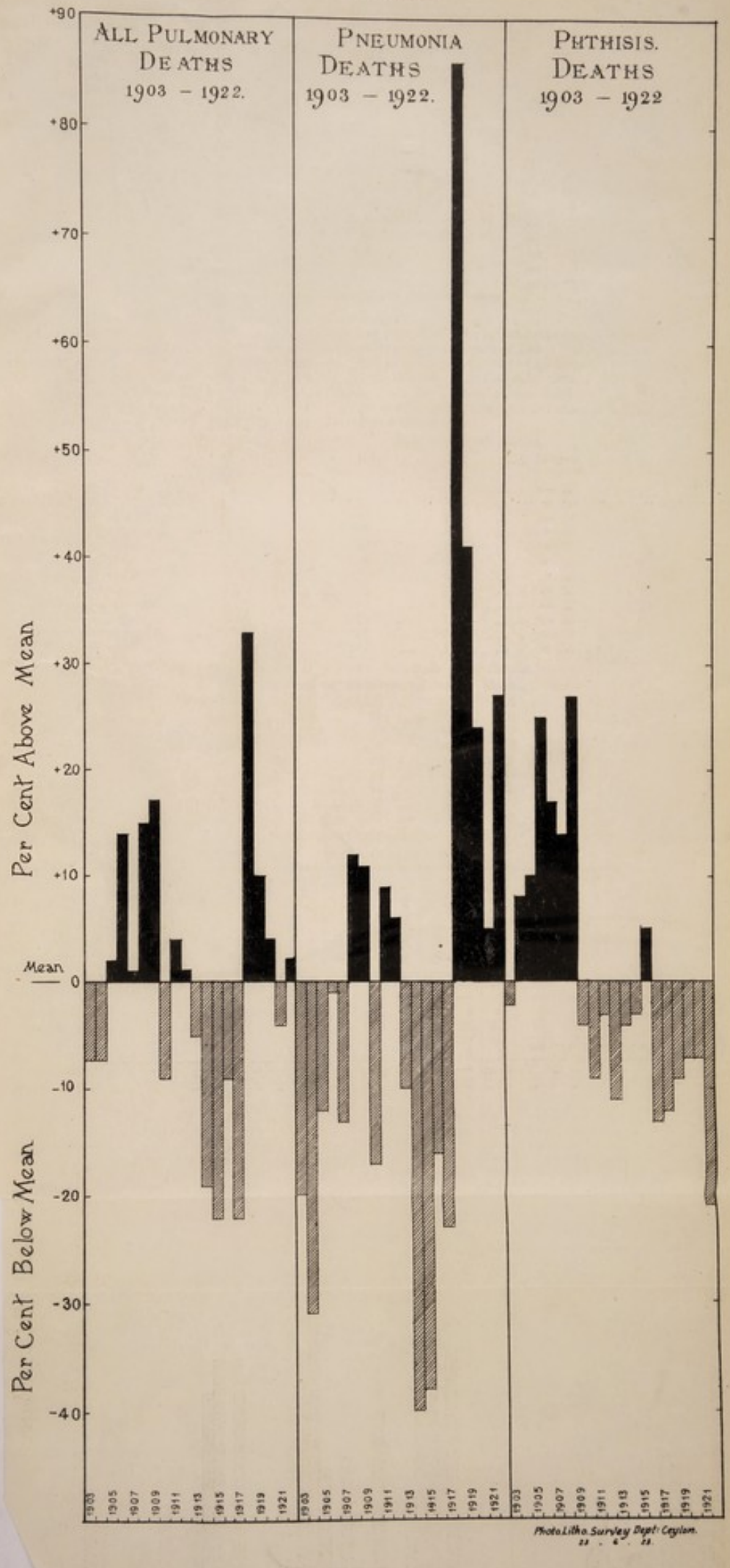
Chart, IV.


INFANT MORTALITY 1903-1922
Per Cent Above Mean
Per Cent Below Mean
Mean
293
50
40
30
20
10
0
10
20
30
1903
1905
1907
1909
1911
1913
1915
1917
1919
1921
Photo Litho Survey Dept. Ceylon.
25 - 6 - 23.

Chart; IV


INFANT MORTALITY 1903-1922
50
40
30
20
10
0
10
20
30
Mean
293
Per Cent Below West
Per Cent Above West

Chart, V


All Pulmonary Deaths 1903 – 1922.
Pneumonia Deaths 1903 – 1922.
Phthisis. Deaths 1903 – 1922
+90
+80
+70
+60
+50
+40
+30
+20
+10
Mean
0
-10
-20
-30
-40
Per Cent Above Mean
Per Cent Below Mean
1903
1905
1907
1909
1911
1913
1915
1917
1919
1921
Photo Litho. Survey Dept: Ceylon.

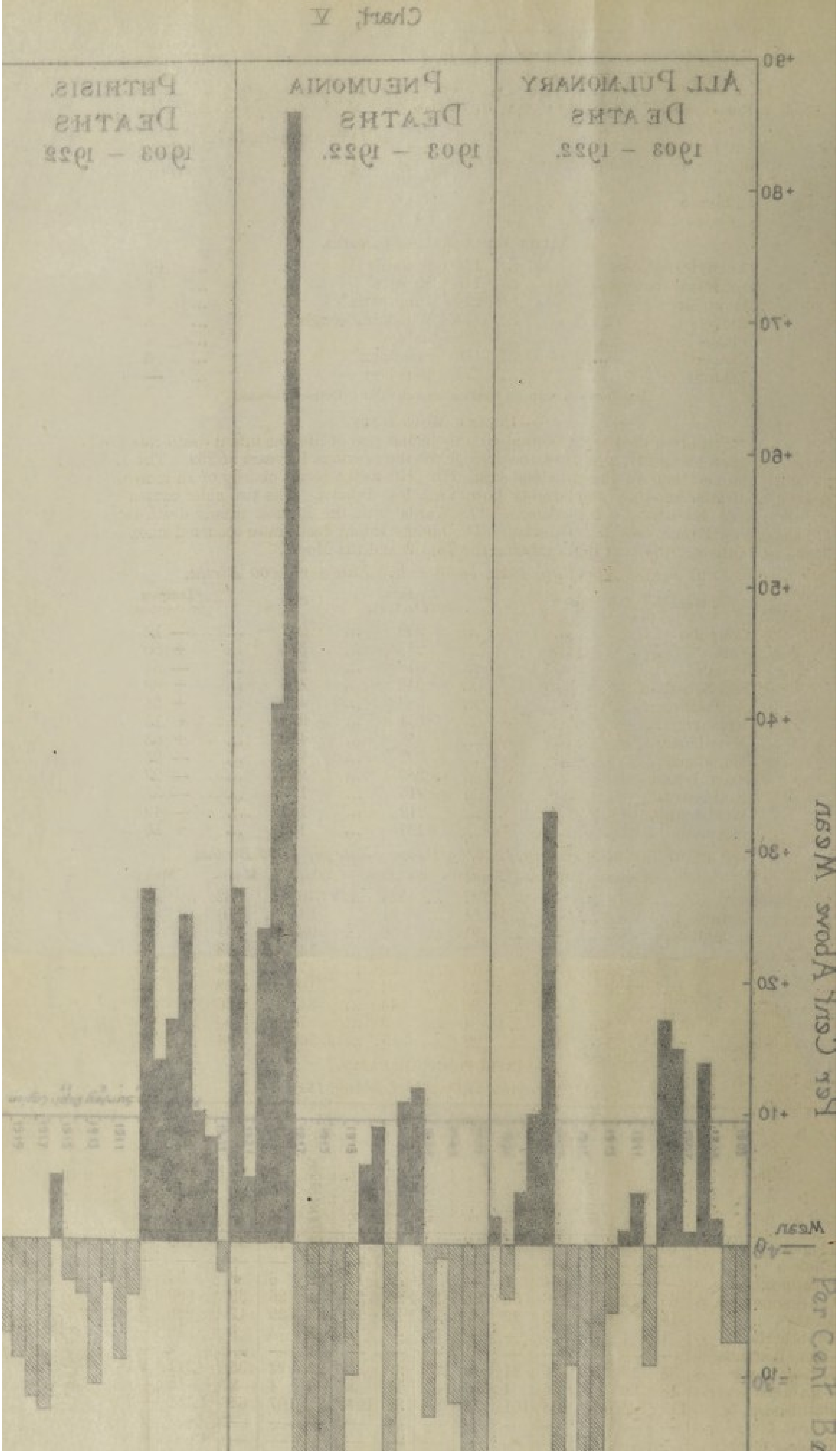


Chart V
All Pulmonary Deaths 1903 – 1922.
Pneumonia Deaths 1903 – 1922.
Phthisis. Deaths 1903 – 1922
Per Cent Above Mean
Mean
Per Cent Below
+90
+80
+70
+60
+50
+40
+30
+20
+10
0
-10

Cause of Death.	No. of Deaths.	
Enteric fever*	179	Total fevers, 357.
Remittent fever	127	
Intermittent fever	—	
Simple and ill-defined fever*	51	
Debility	490	
Influenza	247	
Infantile convulsions	411	

Certain Minor Causes of Deaths.

Anchylostomiasis	135	Syphilis	69
Intestinal parasites	146	Measles*	1
Paralysis	120	Diphtheria*	7
Rickets	53	Whooping cough	3
Plague*	128	Rabies	4
Cancer	96	Smallpox*	6
Tetanus	71	Beri-beri	—

* Those marked with an asterisk are notifiable infectious diseases.

6.—Infant Mortality.

1,702 children died before completing their first year of life, the infant death-rate per 1,000 births registered being 247, as against the average for the previous 10 years of 259. The 1922 rate is slightly higher than in the previous year, viz., 240, as the result mainly of an increase in the number of deaths amongst prematurely born Sinhalese infants. The two chief causes of infant mortality were debility and convulsions. The Wards with the highest infant death-rates were St. Paul's, New Bazaar, and San Sebastian. The highest infant death-rates occurred amongst aliens classed as "Others," the next highest being the Tamils and the Moors.

(9) *Infant Mortality, 1922, by Wards. Rate per 1,000 Births.*

Ward.	Average, 1912 to 1921.	1922.	Increase or Decrease.
Colombo	259	247	— 12
Fort	253	333	+ 80
Pettah	348	294	— 54
San Sebastian	342	405	+ 63
St. Paul's	383	439	+ 56
Kotahena	264	279	+ 15
New Bazaar	359	422	+ 63
Maradana	302	277	— 25
Slave Island	287	260	— 27
Kollupitiya	215	177	— 38
Wellawatta	212	163	— 49
Hospitals	137	152	+ 15

(10) *Infant Mortality, 1922, by Races. Rate per 1,000 Births.*

	All Races.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
All causes	247	12	127	224	340	332	234	427
Premature birth	20	—	14	24	18	10	13	29
Atrophy and debility.	64	—	21	50	98	104	96	155
Bronchitis	7	—	2	6	14	13	4	—
Pneumonia	29	—	18	29	47	24	13	49
Diarrhœal	22	—	23	24	16	22	21	39
Convulsions	60	—	23	44	84	126	50	97
Tetanus	2	—	4	2	7	—	—	19
All other causes	43	12	22	45	56	33	37	39

7.—Infectious Diseases.

(11) *Notifiable Infectious Diseases, 1922.*

Disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for Colombo, exclusive of Port and outside cases.	Port Cases.	Outside Cases.	Grand Total of Cases.
Plague	13	10	6	2	7	8	10	7	7	14	19	33	136	—	3	139
Cholera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Smallpox	—	—	2	4	1	—	1	1	15	2	6	2	34	7	1	42
Chickenpox	65	112	161	116	56	26	15	24	25	34	26	39	699	5	46	750
Measles	14	8	9	10	22	7	12	18	17	33	29	47	226	2	13	241
Diphtheria	1	1	—	3	—	—	3	—	1	1	3	3	16	—	3	19
Acute diarrhœa	—	—	—	—	—	1	—	—	—	1	—	—	2	—	—	2
Enteric fever	33	15	32	26	24	40	28	39	25	22	22	35	341	9	148	498
Continued fever	18	20	9	6	4	15	12	11	8	6	4	2	115	—	12	127
Phthisis	117	105	110	108	101	78	83	86	101	121	107	64	1,181	—	234	1,415
Scarlet fever	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1*
Typhus fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	261	271	329	275	215	175	164	186	199	234	216	225	2,750	24	460	3,234

* Landed from ship in harbour.

The above statistics compared with the previous year represent an increase in the number of cases of smallpox and measles, and a decrease of everything else, see remarks under separate headings.

8.—Pulmonary Group of Diseases.

This group includes pneumonia, phthisis, and bronchitis, of which phthisis alone is notifiable.

(12) *Pulmonary Diseases, 1922, by Race. Rate per 1,000 Population.*

		All Races.	Europeans.	Burghers	Sinhalese.	Tamils.	Moors.	Malays.	Others.
Phthisis	Deaths	640	2	34	347	120	91	24	22
	Death-rate	2·58	0·70	2·26	2·99	2·18	2·26	4·04	1·78
Pneumonia	Deaths	1,159	2	41	629	265	132	27	63
	Death-rate	4·68	0·70	2·72	5·41	4·82	3·28	4·55	5·10
Bronchitis	Deaths	215	1	10	98	52	45	4	5
	Death-rate	0·87	0·34	0·66	0·84	0·95	1·12	0·67	0·41
All pulmonary	Deaths	2,014	5	85	1,074	437	268	55	90
	Death-rate	8·13	1·74	5·64	9·24	7·95	6·66	9·26	7·29

(*a*) *Pneumonia.*—Deaths, 1,159, as against 950 in the previous year. This disease was very prevalent throughout the year, but showed an abrupt increase of mortality during March, a second in June, and a third in October-November. These exacerbations of pneumonia correspond in point of time with an increased prevalence of influenza, and were without doubt to a large extent due to that infection.

(*b*) *Phthisis.*—640 deaths, as against 737 in the previous year. There has been a more or less steady decrease of phthisis in Colombo since 1909, a subject which was discussed at length in section 9 of the Annual Report for 1917. Statement 13 shows the usual extraordinarily high mortality from this disease amongst Malay women.

(13) *Death-rates from Phthisis amongst the Indigenous Races, 1917 to 1922.*

	Males.						Females.					
	1917.	1918.	1919.	1920.	1921.	1922.	1917.	1918.	1919.	1920.	1921.	1922.
Burghers	2·70	1·95	2·70	0·90	2·35	2·49	3·08	2·64	2·49	2·34	1·31	2·09
Sinhalese	2·96	3·37	4·13	4·43	3·35	2·61	3·95	5·97	4·21	4·58	4·08	3·53
Moors	1·57	2·03	1·57	1·82	1·80	1·64	3·07	3·65	3·00	3·00	4·02	3·41
Malays	2·82	1·76	2·11	1·77	2·54	2·90	5·14	5·14	2·77	5·93	6·55	5·44
All Races	2·54	2·71	3·14	3·03	2·53	2·00	4·01	3·93	3·65	4·09	3·79	3·60

(*c*) *Bronchitis.*—215 deaths, as against 183 in 1921. Here, again, influenza has doubtless been to a considerable extent responsible for the increase.

9.—Influenza.

247 deaths were registered as due to this cause, as against 191 in 1921.

As 3,200 cases of this disease were treated during the year at the three Municipal Dispensaries alone, it is probable that the mortality recorded from this disease is considerably understated.

Influenza is not a notifiable disease, but daily records of all cases seen at the Municipal Dispensaries have been kept and charted in this office since the disease appeared in pandemic form in 1918, and these show that this disease was present throughout the year 1922, and developed three fairly well marked waves during January-February, June-July, and to a less degree during October-November. It was apparently, as stated above, largely responsible for the increased mortality from pneumonia and bronchitis, and possibly, to some extent, from diarrhœa, during those same periods. Possibly the increase in the number of premature births amongst the Sinhalese was due to the same cause.

10.—Diarrhœal Group of Diseases.

This group includes diarrhœa, enteritis, and dysentery, none of which are notifiable. The total deaths ascribed to these causes numbered 722, as against 831 during the previous year.

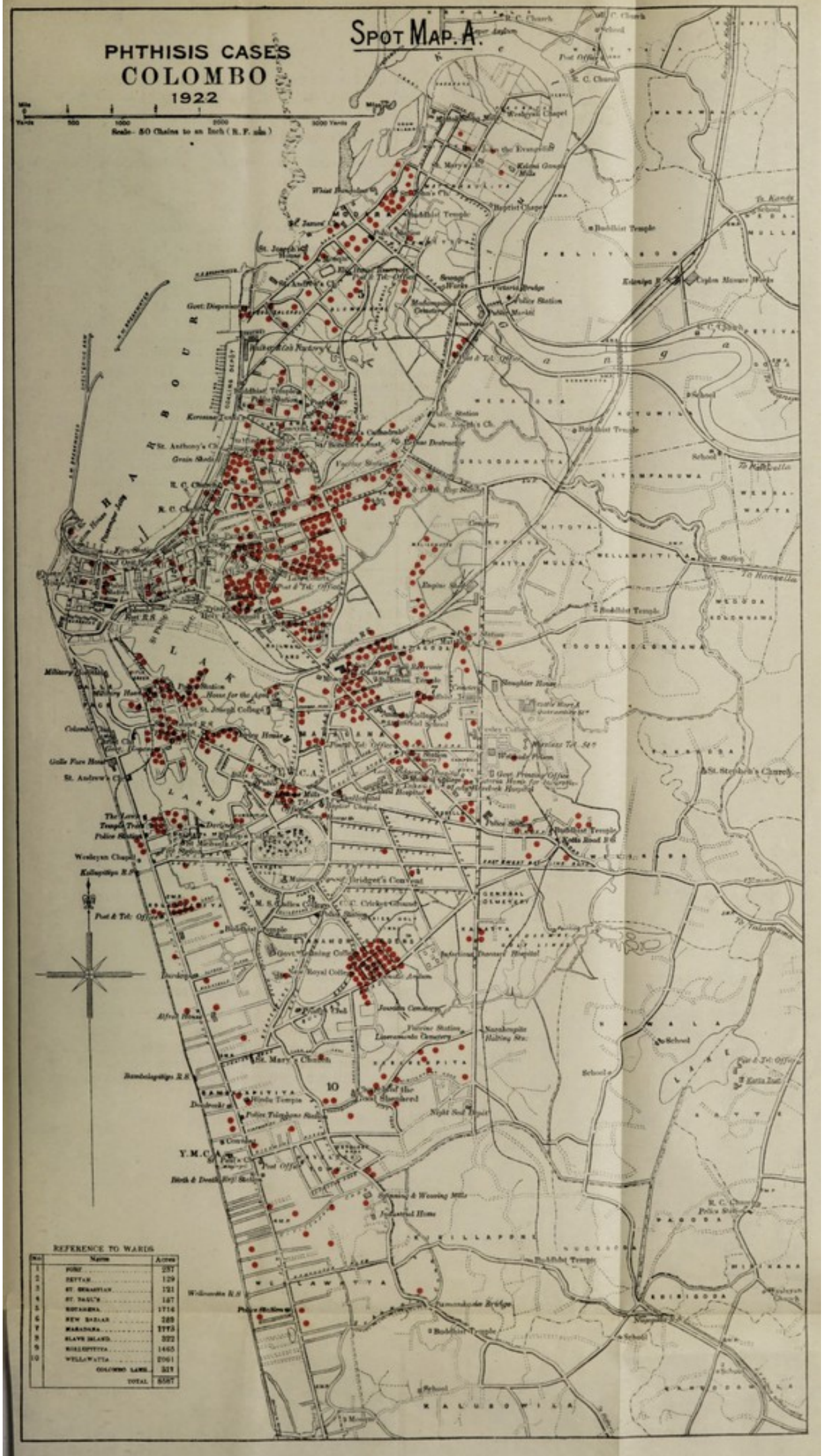
(*a*) *Diarrhœa and Enteritis.*—539 deaths, as against 583 during the previous year.

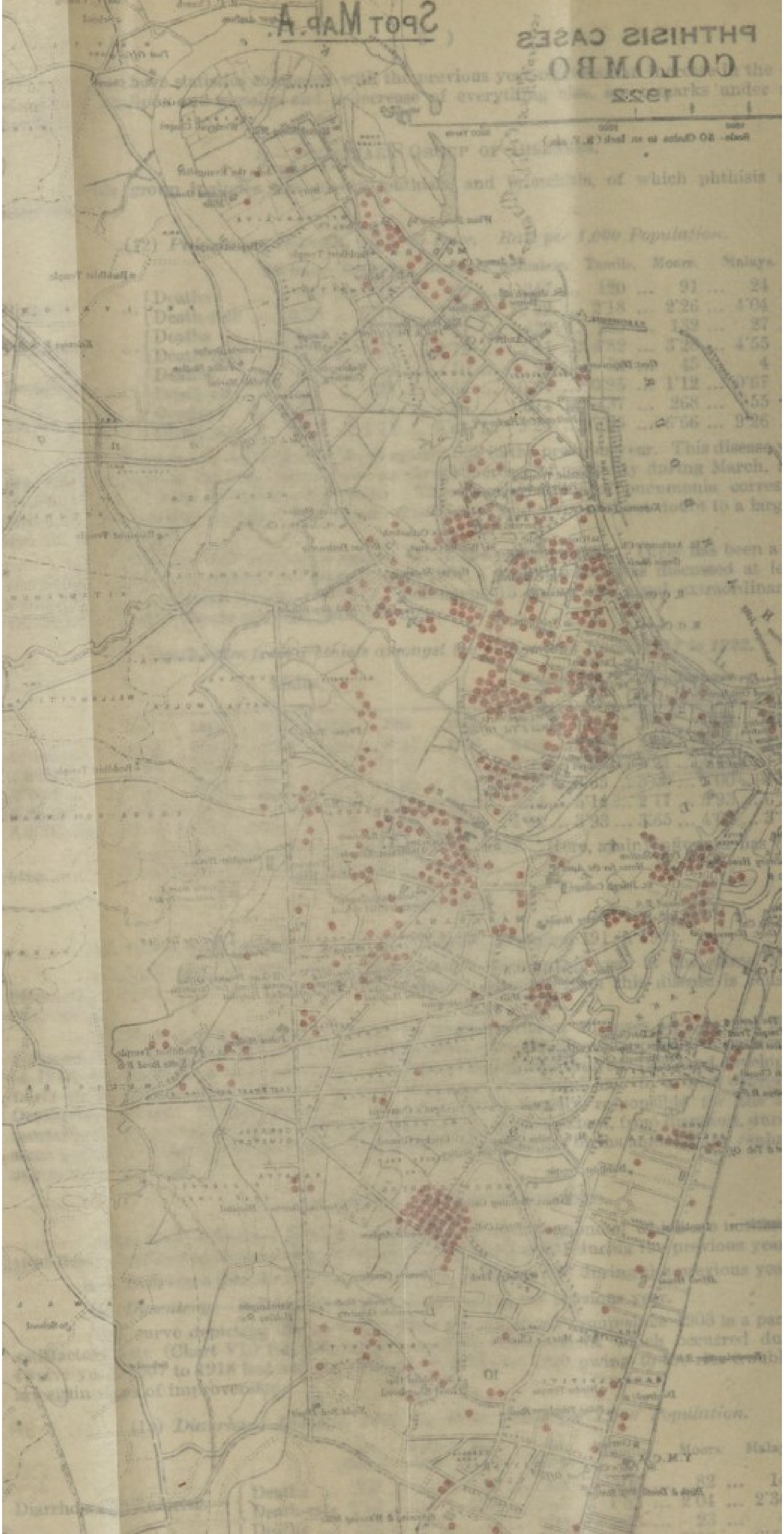
(*b*) *Dysentery.*—183 deaths, as against 248 during the previous year.

The curve depicting the mortality from the diarrhœal group since 1903 is a particularly satisfactory one (Chart VI.) for, although the striking improvement which occurred during the twelve years 1907 to 1918 had a slight set back in 1919 and 1920 owing to the rice troubles, there are again signs of improvement.

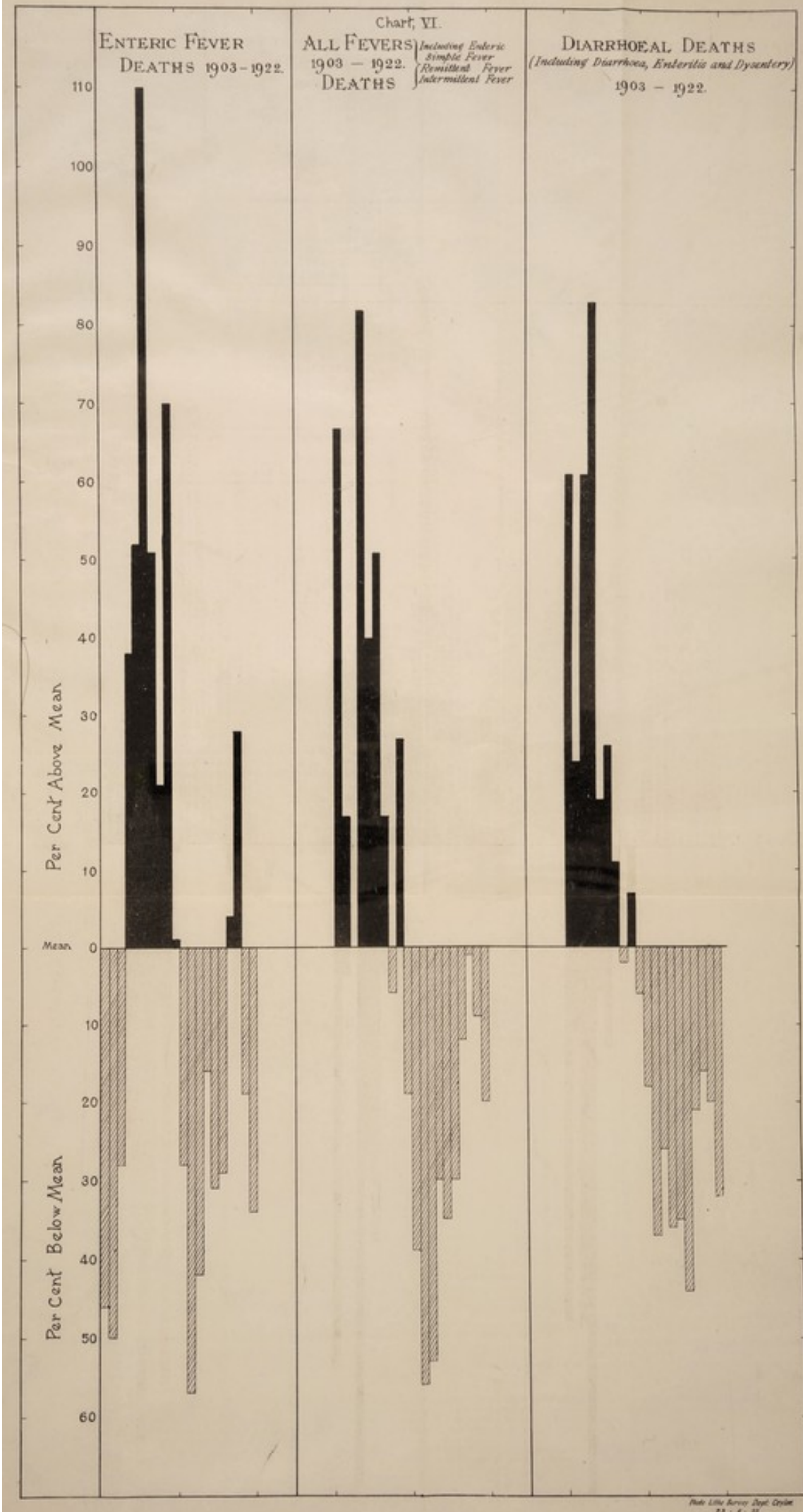
(14) *Diarrhœal Diseases, 1922, by Race. Rate per 1,000 Population.*

		All Races.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
Diarrhœa and Enteritis	Deaths	539	—	24	308	106	82	14	5
	Death-rate	2·18	—	1·60	2·65	1·93	2·04	2·36	0·41
Dysentery	Deaths	183	—	11	104	36	23	4	5
	Death-rate	0·74	—	0·73	0·89	0·66	0·57	0·67	0·41
All diarrhœal	Deaths	722	—	35	412	142	105	18	10
	Death-rate	2·92	—	2·33	3·54	2·59	2·61	3·03	0·82


PHTHISIS CASES
COLOMBO
1922
SPOT MAP. A.
Scale - 80 Chains to an Inch (S. P. sht.)
REFERENCE TO WARDS
No. Name Acres
1 FORT 287
2 PETTAH 129
3 ST. SEBASTIAN 121
4 ST. PAUL'S 147
5 KOTAHENA 1714
6 NEW BAZAAR 289
7 MARADANA 1773
8 SLAVE ISLAND 372
9 HULFTSDORP 1465
10 WELLAWATTA 2061
COLOMBO LAKE 319
TOTAL 8587


SPOT MAP A.
PHTHISIS CASES
COLOMBO
1922

Chart, VI.



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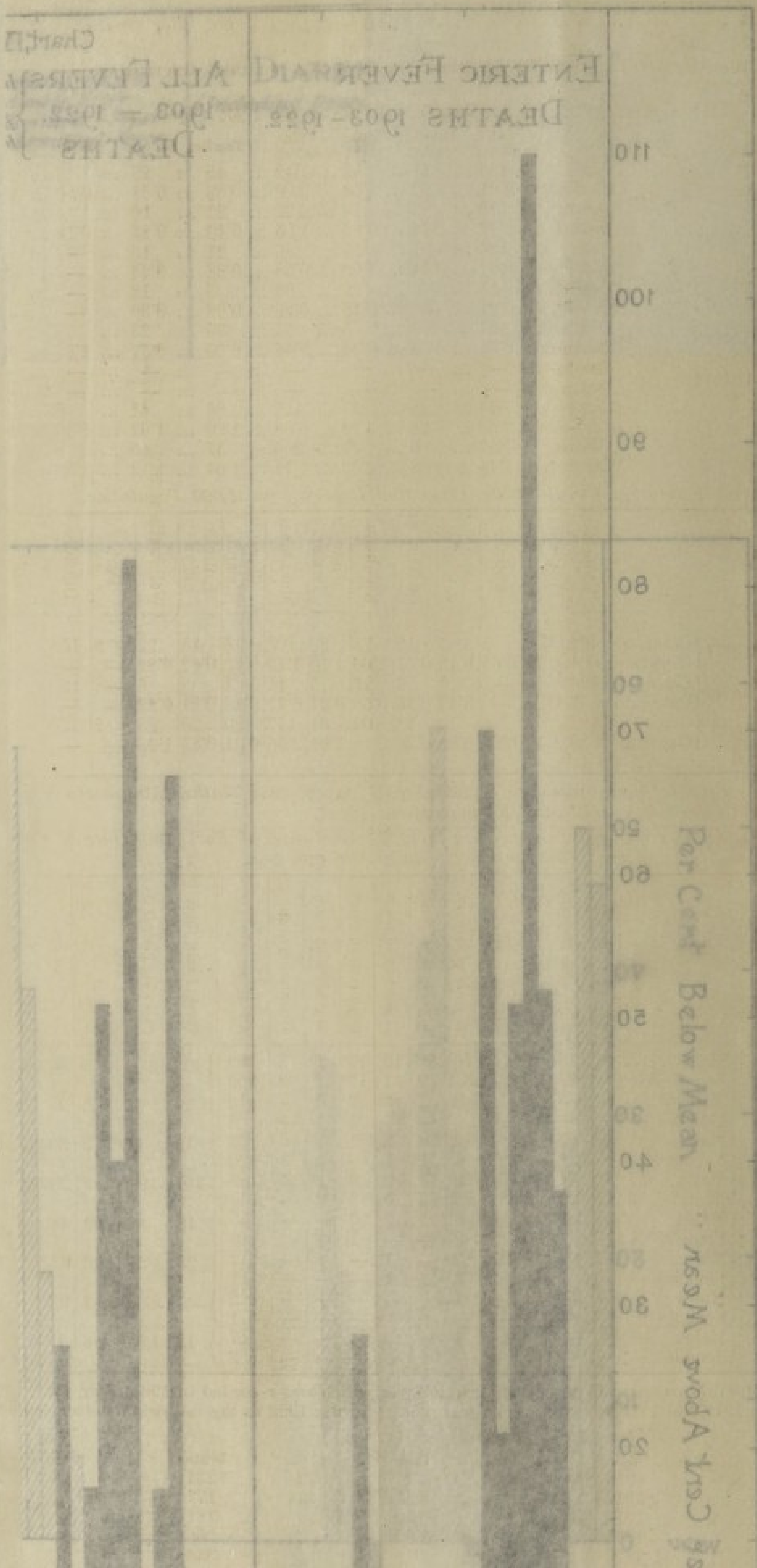

Per Cent Below Mean
Per Cent Above Mean

11.—Fevers.

Under this heading are included enteric, paratyphoid, remittent, intermittent, and simple continued fevers.

(15) *Fevers, 1922. Cases, Deaths, and Rates per 1,000 Population.*

		All Races.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
Enteric fever	Cases	498	17	42	349	45	23	3	19
	Case-rate	2·01	5·91	2·79	3·00	0·82	0·57	0·50	1·54
	Deaths	179	5	13	122	22	10	1	6
	Death-rate	0·72	1·74	0·86	1·05	0·40	0·25	0·17	0·49
Continued fever	Cases	126	1	15	66	21	18	—	5
	Case-rate	0·51	0·34	1·00	0·58	0·38	0·45	—	0·41
	Deaths	51	—	2	30	5	12	—	2
	Death-rate	0·21	—	0·13	0·26	0·09	0·30	—	0·16
Remittent fever	Deaths	127	1	5	54	30	23	8	6
	Death-rate	0·51	0·34	0·33	0·46	0·55	0·57	1·35	0·49
Intermittent fever	Deaths	—	—	—	—	—	—	—	—
	Death-rate	—	—	—	—	—	—	—	—
All fevers	Cases	624	18	57	415	66	41	3	24
	Case-rate	2·52	6·25	3·79	3·58	1·20	1·02	0·50	1·95
	Deaths	357	6	20	206	57	45	9	14
	Death-rate	1·44	2·08	1·32	1·77	1·04	1·12	1·52	1·14

(16) *Fevers by Wards, 1922. Cases and Case-rate per 1,000 Population.*

		Colombo.	Fort and Galle Face.	Pettah.	San Sebastian.	St. Paul's.	Kotahena.	New Bazaar.	Maradana.	Slave Island.	Kollupitiya.	Wellawatta	Port.	Outside.	Untraced.
Enteric fever	Cases	498	2	5	5	12	75	26	103	16	15	22	9	148	60
	Case-rate	2·01	0·73	0·65	0·43	0·51	1·60	1·10	1·79	0·73	0·62	0·81	—	—	—
Continued fever	Cases	126	1	—	5	6	27	5	44	4	5	6	—	12	11
	Case-rate	0·51	0·37	—	0·43	0·25	0·58	0·21	0·77	0·18	0·21	0·22	—	—	—
All fevers	Cases	624	3	5	10	18	102	31	147	20	20	28	9	160	71
	Case-rate	2·52	1·10	0·65	0·86	0·76	2·18	1·31	2·56	0·91	0·83	1·03	—	—	—

(*a*) *Enteric fever* (including Paratyphoid). *Cases*, 498; *deaths*, 179; *cases mortality*, 36·0 per cent.; *death-rate*, 0·72 per 1,000 population.

(17) *Enteric Cases reported during the Year 1922 (inclusive of Port and Outside Cases). Distribution by Race, Age, and Sex.*

Race.	Sex	0 to 5 years	5 years to 10 years.	10 years to 15 years.	15 years to 20 years.	20 years to 25 years.	25 years to 30 years.	30 years to 35 years.	35 years to 40 years.	40 years to 50 years.	50 years to 60 years.	60 years and over.	All Ages.	Total of each Race.	Case Rate Per 1,000 Population.	Deaths.	Case Mortality Per Cent.	Mortality per 1,000 Population.
All Races	Males	8	20	48	46	52	40	31	19	17	5	3	289	498	2·01	179	36·0	·72
	Females	6	25	29	21	36	35	19	11	17	7	3	209					
Europeans	Males	—	—	—	1	2	3	1	2	2	1	—	12	17	5·91	5	29·4	1·74
	Females	—	—	—	1	—	2	—	—	1	1	—	5					
Burghers	Males	1	2	7	2	1	2	3	1	1	—	2	22	42	2·79	13	30·9	·86
	Females	2	2	2	3	3	1	1	1	—	2	3	20					
Sinhalese	Males	7	15	34	34	34	20	18	11	12	3	1	189	349	3·00	122	35·0	1·05
	Females	3	22	24	12	29	27	15	9	15	4	—	160					
Tamils	Males	—	2	4	7	5	8	5	2	2	—	—	35	45	·82	22	48·8	·40
	Females	1	—	1	3	2	2	—	—	1	—	—	10					
Moors	Males	—	1	3	1	3	2	—	1	—	1	—	12	23	·57	10	43·5	·25
	Females	—	1	2	—	2	3	2	1	—	—	—	11					
Malays	Males	—	—	—	1	—	1	—	—	—	—	—	2	3	·50	1	33·3	·17
	Females	—	—	—	1	—	—	—	—	—	—	—	1					
Others	Males	—	—	—	—	7	4	4	2	—	—	—	17	19	1·54	6	31·5	·49
	Females	—	—	—	1	—	—	1	—	—	—	—	2					

The improvement in respect of enteric fever which was recorded in 1921, after the severe set back in 1919 and 1920, was more than maintained during 1922 as the following shows :—

Statement (17 (a)).

Year.	Cases.	Deaths.
1916	514	231
1917	424	174
1918	430	181
1919	682	268
1920	879	338
1921	572	219
1922	498	179

This improvement may be attributed, in part at least, to the special efforts which were made during 1921 and 1922 to check the spread of infection, by systematic and frequent visiting of all cases undergoing home treatment, so as to ensure the proper isolation of the patient, the disinfection, protection, and prompt removal of dejecta, the disinfection of articles in use by the patient, the carrying out of preventive measures by those in attendance upon the patient, and the cleansing and disinfection of all closets, but especially of pail closets in the infected localities. This preventive work is carried out by the Sub-Inspectors with the aid of the disinfecting and cleansing staff, under the supervision of the Sanitary Inspectors, and subject to direct control by the Junior Assistant Medical Officer of Health.

Case mortality.—By this term is meant the proportion of the total cases notified which proved fatal, and should not be confused with the case-rate, or the death-rate from this disease, which indicate the proportion of the total population *attacked*, or *killed* respectively by the disease. Thus, to take an exaggerated example, if ten cases of enteric occur amongst a population of 1,000 persons, and five of those ten cases prove fatal, the case mortality or fatality would obviously be 50 per cent., whereas the case-rate would be 10 per 1,000 and the death-rate 5 per 1,000 of the total population. The case mortality thus indicates the severity or virulence of the infection, whereas the case-rate, and, less accurately, the death-rate indicate the prevalence of the disease amongst the population.

The case mortality is of great value, not only as an indication of the virulence of the disease, but also as a means of estimating the actual, as opposed to the recorded, prevalence of the disease. This especially applies to a disease like enteric fever which, as exhaustive inquiries in all parts of the world have shown, has a comparatively limited range of true case mortality. Published records show that the true case mortality for enteric fever rarely exceeds 20 per cent. and is generally between 10 and 15 per cent., provided the case mortality rate is based upon a sufficiently large number of cases to warrant the striking of an average. It would be absurd, for example, to say because two cases occurred in a town, or anywhere else for that matter, and both proved fatal, giving a case mortality of 100 per cent. that therefore the disease was of a particularly virulent type; but if, say, 100 or more cases occurred, and all proved fatal, one would be justified in concluding that the infection was of a very virulent type, more so even than smallpox, or bubonic plague.

Turning now to the case of Colombo, it has frequently been remarked in these reports that the extraordinarily and consistently high case mortalities recorded here in connection with enteric, viz., from 30 to 40 per cent., are obviously fallacious. The true case mortality here for the population as a whole is probably not more than, if indeed as much as 15 per cent. To explain these high recorded case mortalities there must be a large number of mild non-fatal cases which escape recognition, or at least notification. If one assumes that the true case mortality here is much the same as in other parts of the world where diagnosis and notification are on a more satisfactory footing, one can calculate the probable number of mild non-fatal cases which have escaped notification, and thus estimate the true prevalence of the disease here. If, for example, the true case mortality for all cases of enteric in Colombo in 1922 was 15 per cent. and not 36 per cent. as recorded, then the 179 recorded deaths must represent 1,193 cases, instead of 498 as notified. There must therefore have been, during the year, 695 cases of enteric fever which escaped notification *as such*. Probably a considerable number of the 115 cases, which were notified as simple continued fever, were in reality mild cases of enteric, and if all were of this nature, which is of course highly improbable, it would reduce the total of unnotified cases to 580. Then, again, a number of cases diagnosed as remittent fever or influenza (neither of which are notifiable) may have been mild cases of enteric; but even allowing for all these there must still be a very large number of mild cases of enteric which escape recognition and notification, a large proportion of which probably occur amongst children, who, as is well known, are liable to suffer from this disease in a mild typical form. Although the majority of these unrecognized cases are probably mild in character, they are nevertheless highly infectious, and are liable on transmission to set up a virulent form of the disease in other and less resistant persons. This is one, and indeed probably the chief reason why enteric fever, when it becomes endemic in a town, is so very difficult to control. Another reason is the existence of "carriers," the great danger from which was well illustrated in the case recorded in the 1920 report.

A closer examination of the data as regards case mortality, furnished by statement 17, throws still further light upon this subject of unnotified cases, especially if taken in conjunction with the data given in statement 15.

Statement 15 shows that if the effect of errors in diagnosis between the various fevers is, as far as possible, eliminated by grouping the deaths from all readily mistakable fevers together, the Europeans suffered most from these causes during 1922, in proportion to their population. This is probably correct, since it is well known that not only are Europeans peculiarly susceptible to enteric, especially when they first arrive in or return to the tropics, but they are also liable when attacked, to suffer from this disease in a severe form, and have therefore a genuinely high case mortality. Nevertheless, as statement 17 shows, their case mortality of 29·4 per cent. in 1922, is *lower* than that recorded for any other race. The inference to be drawn from this is that diagnosis and notification are more accurate and complete amongst Europeans than amongst any of the other races, which is without doubt the case.

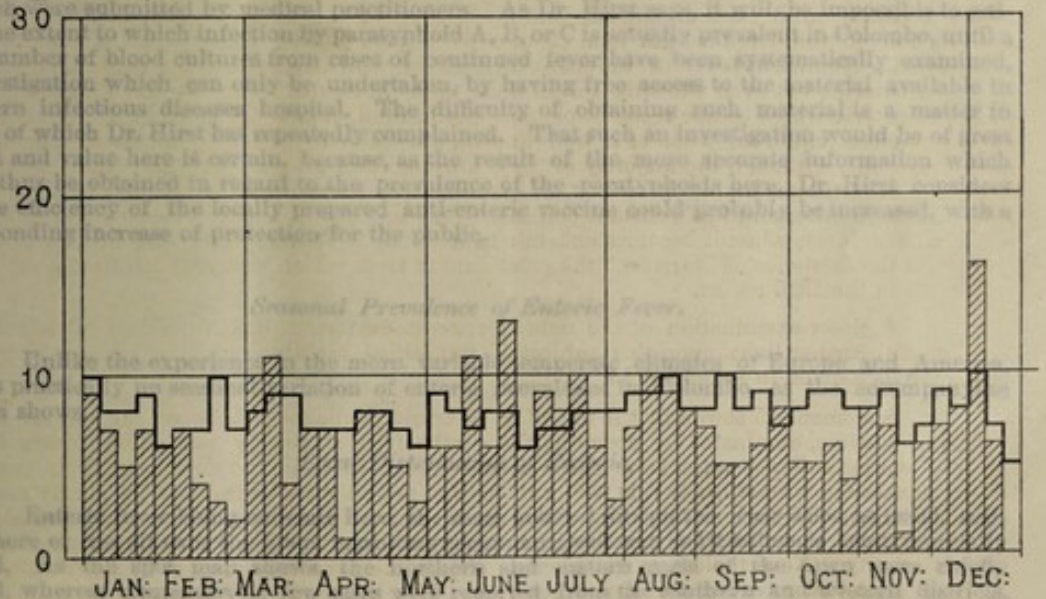
A point to be observed in connection with the European rate is that, owing to the paucity of the data (they had only seventeen cases in all with five deaths), their case mortality rate is liable to great and more or less chance variations, irrespective of the degree of virulence of the infection. For example, their case mortality may be considerably influenced by variations in the degree of susceptibility of the comparatively few individuals attacked, whereas in a numerous race like the Sinhalese, with a large number of cases, the effect upon their case mortality rate of variations in the susceptibility of individuals would be so slight as to be practically negligible. For this reason a high case mortality such as 35 per cent. amongst the Sinhalese may confidently be ascribed to the fact that the rate is based upon returns from which a large number of non-fatal cases have been omitted.

Chart, VII

Enteric Fever Cases 1922

Shaded - 1922

Plain - Average 1913-1922.



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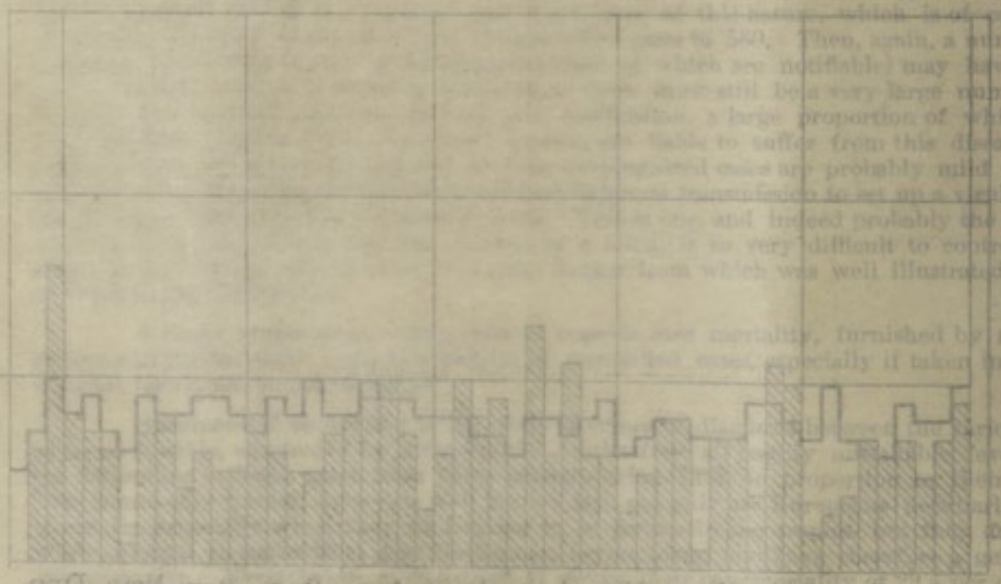


Following upon the lines indicated above and assuming a true case mortality of say 15 per cent. for each race here, the cases which have apparently escaped notification can be roughly estimated for each race with the following result :—

Estimate of unrecorded non-fatal cases of enteric during 1922, assuming a flat case mortality rate of 15 per cent.

Statement (17 (b)).

	Recorded Cases.	Recorded Deaths.	Calculated Cases.	Missing non-fatal Cases.
All races ...	*498*	*179*	*1,193*	*695*
Europeans* ...	17	5	33	16
Burghers ...	42	13	86	44
Sinhalese ...	349	122	813	464
Tamils ...	45	22	146	101
Moors* ...	23	10	66	43
Malays* ...	3	1	6	3
Others* ...	19	6	40	21

* In the case of Europeans, Moors, Malays, and "Others".

The total events dealt with are too few in number to give reliable results by this method; but in the case of Sinhalese, Burghers, and Tamils, and especially the Sinhalese, it is probable that the results are not very wide of the mark, and it will be conceded that to have over 400 cases of enteric fever occurring in the town during one year, which are not notified and in respect of which no preventive measures are in consequence adopted, is a very serious matter indeed. There can be little doubt that the responsibility for this state of affairs rests mainly with the vedarala, who, unlike the fully-qualified up-to-date medical practitioner, never takes advantage of bacteriological examinations, which are conducted free of cost by the Municipality, to verify or correct his diagnosis.

The Problem of Simple Continued Fever.

Although, as Dr. Hirst points out in his report annexed, very little is known in regard to the real nature of the so-called simple continued and intermittent fevers, or the prevalence of the paratyphoids in Colombo, there appears to be a growing tendency amongst some of the medical practitioners to diagnose these continued and intermittent fevers as paratyphoid or malaria, on clinical grounds alone. This is very unsatisfactory, because these fevers can only be definitely diagnosed by the isolation of the causative organism, as the result of a bacteriological examination, which is very seldom done in the case of the continued fevers. During the year 1922, for example, not a single case of paratyphoid was isolated from the specimens sent in to the Municipal Laboratory, although fifty-three positive cases of enteric were found in 617 specimens received, only sixty-nine of which were submitted by medical practitioners. As Dr. Hirst says, it will be impossible to estimate the extent to which infection by paratyphoid A, B, or C is actually prevalent in Colombo, until a large number of blood cultures from cases of continued fever have been systematically examined, an investigation which can only be undertaken, by having free access to the material available in a modern infectious diseases hospital. The difficulty of obtaining such material is a matter in respect of which Dr. Hirst has repeatedly complained. That such an investigation would be of great interest and value here is certain, because, as the result of the more accurate information which would thus be obtained in regard to the prevalence of the paratyphoids here, Dr. Hirst considers that the efficiency of the locally prepared anti-enteric vaccine could probably be increased, with a corresponding increase of protection for the public.

Seasonal Prevalence of Enteric Fever.

Unlike the experience in the more variable temperate climates of Europe and America, there is practically no seasonal variation of enteric prevalence in Colombo, as the accompanying diagram shows.

Local Distribution of Enteric.

Enteric fever being endemic here, the cases notified during the year were, as usual, scattered more or less all over the town, insanitary tenement areas such as Dematagoda being especially affected. As the spot map shows, the northern and eastern parts of the town were chiefly affected, whereas comparatively few cases were reported from the southern and western districts. The freedom of the Cinnamon Gardens, where notification is better than anywhere else, is a striking feature of the spot map. As will be seen, the distribution of simple continued fever (blue spots) follows closely the distribution of enteric (red spots) which lends support to the conclusion recorded earlier in this report, that a large proportion of these cases are probably in reality mild cases of enteric fever.

(*b*) *Malaria.*—Malaria is not a notifiable disease and, consequently, in order to obtain reliable evidence in regard to its prevalence here, one has to resort to laborious investigation of (*a*) the Municipal Dispensary returns, (*b*) Hospital records, (*c*) reports by Sanitary Inspectors, (*d*) voluntary notifications by medical practitioners, and (*e*) the death returns furnished by the Registrar-General.

The greatly increased prevalence of malaria in the Island as a whole, which was recorded in 1921, was exceeded during 1922 as the following figures, kindly furnished by the Principal Civil Medical Officer show :—

Statement (18).—Malaria Cases Treated.

Year.	All Ceylon.	Western Province, exclusive of General Hospital, Colombo.	General Hospital Colombo.
1920	16,538	2,807	767
1921	27,447	4,036	1,119
1922	28,925	6,754	2,151
Increase in 1922 ...	1,478	1,718	1,032

These figures appear, at first sight, to indicate that a great outbreak of malaria occurred in Colombo during the last two years. This is, however, not the case, for, although many more than the usual number of cases were *treated* in Colombo, very few of these were found upon inquiry to have acquired their infection in the town. The vast majority of the cases treated in the town were found upon inquiry to be imported cases which had come to Colombo for treatment. Thus out of a total of 1,611 cases diagnosed as malaria at the Municipal Free Dispensaries during 1922, no less than 1,362 or 84 per cent. gave a definite history of residence in other parts of the Island at the time of infection and first attack, while of the remaining 249 cases which were returned by the Dispensary Medical Officers as believed to have been infected in the town, only six could be traced to definite addresses in the town, and even these were by no means certain cases of malarial infection, as the diagnosis was not confirmed by microscopic examination. It is, however, believed that three of these (from Dematagoda) were genuine cases of autochthonus malaria, as a dangerous malaria carrier, viz.,—*Anopheles culicifacies*—identified by Mr. Carter—was found breeding in small numbers in the neighbourhood. This conclusion is further supported by the results of the spleen examination conducted by Mr. Carter, and which are given in his notes quoted hereafter. No malaria-carrying anopheles were found in connection with the other three cases referred to above. So far, therefore, as the evidence from the Municipal Dispensaries goes, nothing in the nature of an outbreak of malaria acquired within the town occurred during the year, but a few sporadic cases, locally infected, appear to have occurred at Dematagoda.

Although malaria is not a notifiable disease, one or two keen physicians practising in the town have been kind enough to notify such cases as came under their care, and which appeared to have been infected in the city. All such cases are at once investigated by this department, including a thorough search of the locality for the breeding places of anopheles. Thus during the year 1922 eleven cases of malaria were notified by practitioners, but it was found upon inquiry that three of these were old malarious subjects who had visited malarious districts in other parts of the Island, where they had in all probability acquired the infection. The evidence obtained regarding the remaining eight cases points to their having acquired the infection in the town. These cases lived in the following localities, viz.,—Torrington place, Albert crescent, Turret road (two cases), Horton place, Norris road, San Sebastian hill, and the Fort—the last mentioned having, however, spent a night and apparently been infected at Glennie street. It is an interesting fact that in every one of these cases *Anopheles sinensis* were found breeding in the neighbourhood, whereas neither *A. culicifacies* nor *A. listoni*, the two dangerous carriers which are known to occur here, were found anywhere near these cases, although carefully searched for. This appears to lend further support to the view, expressed in the 1921 Report, that *Anopheles sinensis*, although not usually a carrier here, may perhaps at times act as such. It has not, however, been convicted here yet by the finding of sporozoits.

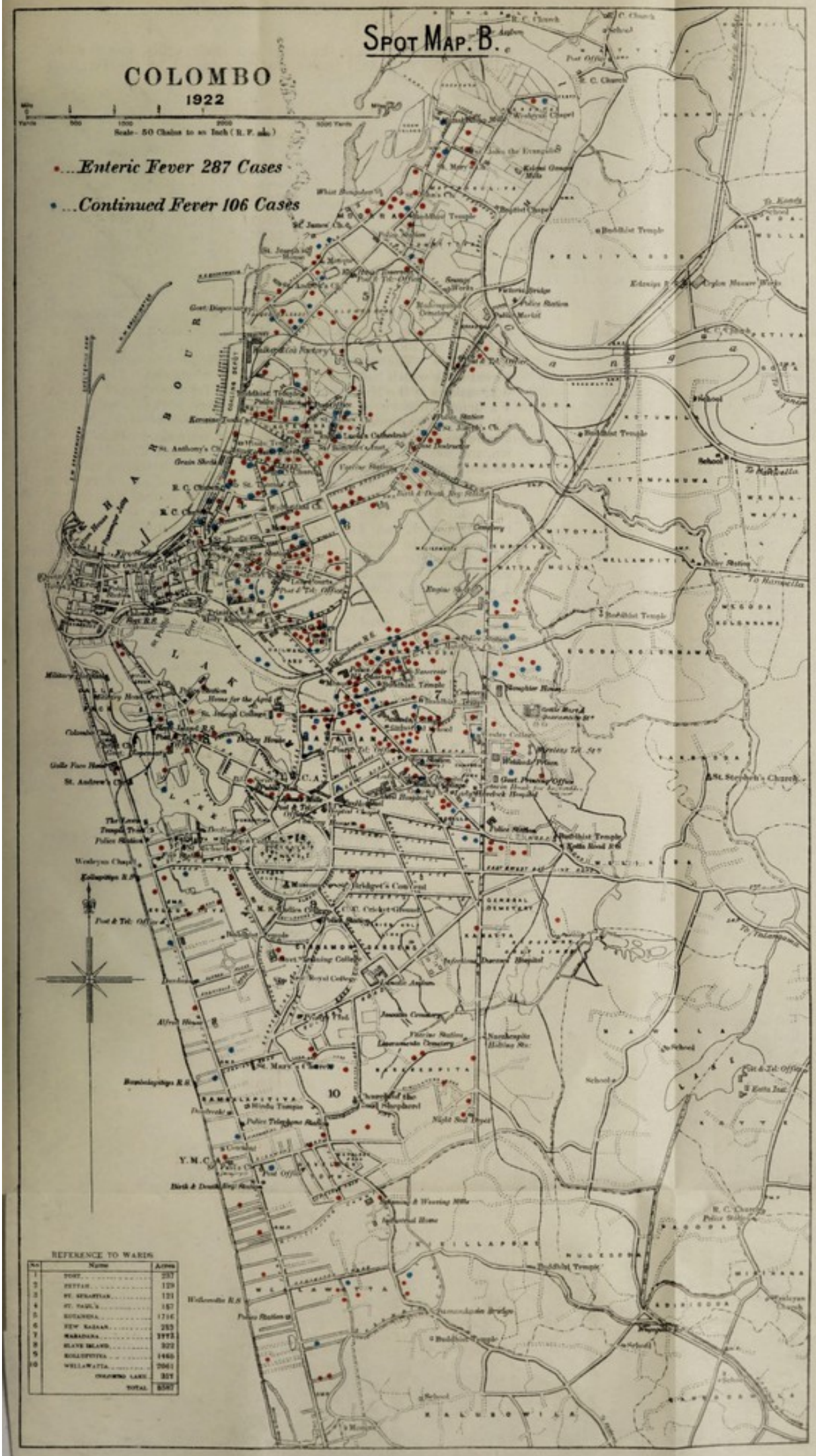
Inquiries made, with the kind assistance of the late Dr. Alan Kidd, in regard to the cases treated in the General Hospital during January, 1922, when the disease was said to be prevalent, were equally unsuccessful in establishing the occurrence of anything in the nature of an outbreak in the town of locally acquired malaria.

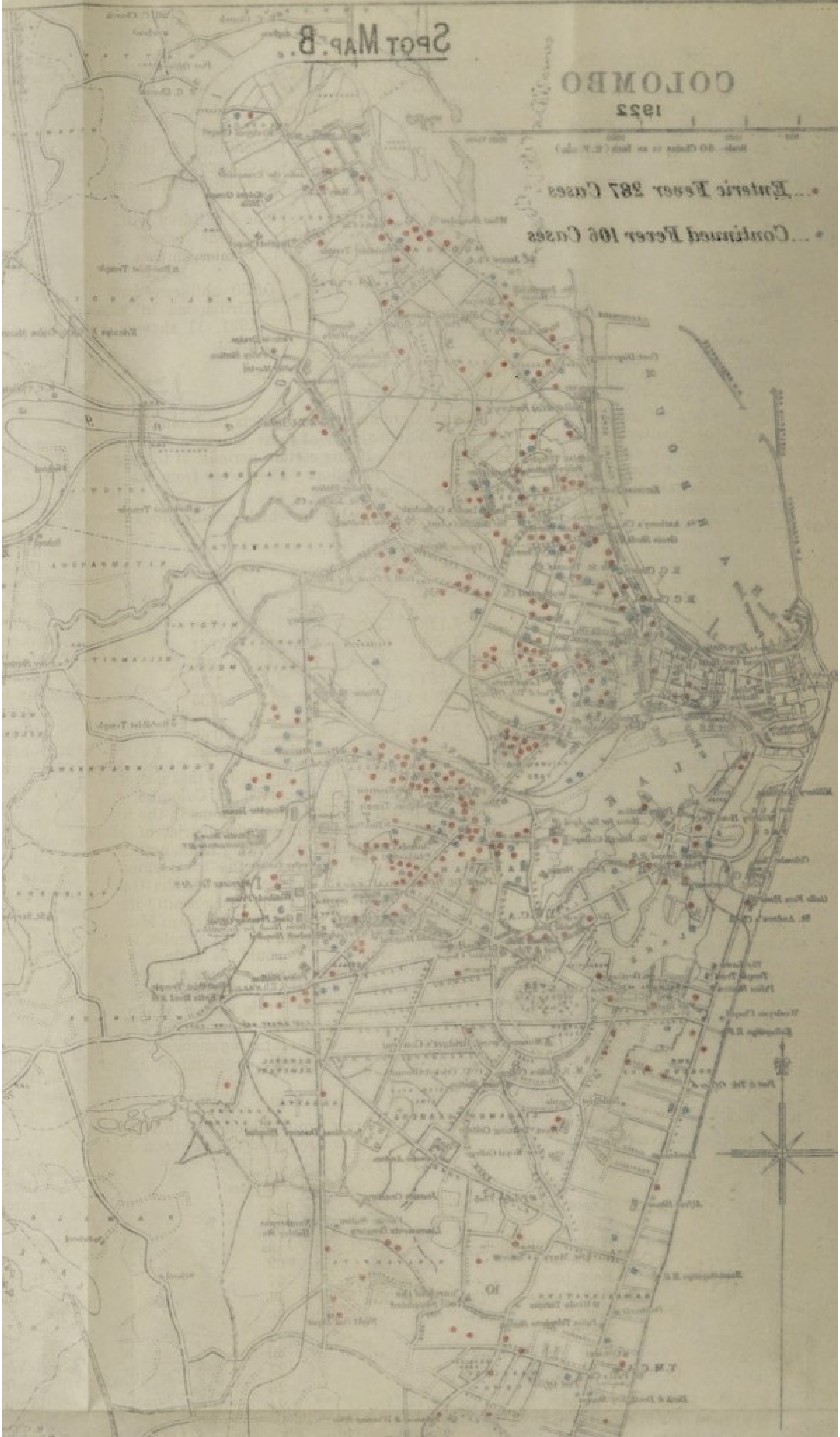
As regards the death returns, only 127 deaths from malaria were registered during the year, out of a total of 8,169 deaths from all causes in the town. As most of these were hospital cases, and they were all dead and buried before they came to our knowledge, it was impossible to trace the source of their infection; but there can be little doubt that, just as in the dispensary cases, the great majority of them were infected elsewhere. The figures certainly cannot be adduced as evidence of an outbreak of malaria acquired in the town.

In conclusion, I am indebted to Mr. Henry F. Carter, the Malariologist, for the following very interesting notes in regard to malaria in Colombo.

Mr. Carter's Notes.

"*Colombo, and in fact the greater part of the Western Province, must be considered remarkably free from Malaria.* Spleen and blood examination of large numbers of school and other children show that the endemic index and parasite rate are much lower than in any other Province . . . . . with regard to the spleen work in the Municipality, we have now examined 3,468 children under twelve years of age. This sample should, I think, be sufficient to provide fairly reliable results.


SPOT MAP. B.
COLOMBO
1922
Scale - 50 Chains to an Inch (R. F. 1/3960)
...Enteric Fever 287 Cases
...Continued Fever 106 Cases
REFERENCE TO WARDS
Fort 237
Pettah 139
St. Sebastian 121
St. Paul's 167
Kotahena 1716
New Bazaar 283
Maradana 3993
Slave Island 322
Kollupitiya 1460
Wellawatta 2061
Cinnamon Gdns. 357
Total 8567


Spot Map. B.
COLOMBO
1922
...Enteric Fever 287 Cases
...Continued Fever 106 Cases

The following are the completed results for the district :—

Statement (18 (a)).

Locality.	Children examined.	Children positive.	Spleen rate per Cent.	Remarks.
Colombo Municipality	3,468	24	0·69	Excluding 6 children with enlarged spleens from malarious districts.
Dehiwala, Mt. Lavinia, Moratuwa, Kesbawa, Pannipitiya	2,467	4	0·16	The 4 children with enlarged spleens were all from Boralesgamuwa.
Wellampitiya, Talangama, Kotte, Nugegoda	546	19	3·5	Of 30 children examined in Kirillapona in December, 1921, 11 showed enlargement.
Colombo District (total) (radius 10 miles)	6,481	47	0·7	—

If the six children with enlarged spleens from malarious districts be included, the spleen rate for the Municipality becomes 0·87 per cent. The majority of these children were boarders at various schools, and it may be presumed, therefore, that during certain periods of the year (when they return to their homes) they are more exposed to infection. They were from the following towns :—Polgahawela, Chilaw, Kurunegala, and Kahawatte."

The figures for the different wards of the Municipality in which examinations were made are :—

(*Statement 18 (b)*).

Ward.	Children examined.	Children positive.	Spleen rate per Cent.
Kollupitiya	239	3	1·25
Wellawatta	1,128	6	0·53
Slave Island	1,651	4	0·61
Maradana	912	7	0·76
Kotahena	257	3	1·16
St. Paul's	281	1	0·35
Municipality	3,468	24	0·69

The conclusion arrived at, after a review of all the evidence recorded, is that a comparatively small number of sporadic cases of locally acquired malaria has occurred in Colombo, especially during the last two years, the areas chiefly affected being the Cinnamon Gardens in the neighbourhood of Victoria park, the semi-rural parts of Kotahena, the Dematagoda district of Maradana, Slave Island near the lake, and the inland parts of Wellawatta. On the other hand, nothing worthy of the name of an outbreak of locally-acquired malaria has occurred in the town since 1903–04 when the strictly localized but very sharp outbreak occurred in connection with the Government quarry at Mutwal. The sensational statement which unfortunately appeared recently in a leading article in Volume XIX., Part III. of the Journal of the Ceylon Branch of the British Medical Association, that malaria, acquired for the most part in the town, was rampant in Colombo, is thus seen to be quite unjustified, and very misleading. At the same time it would be folly to ignore the danger to the town which is associated with the existence of such large numbers of imported cases of malaria as are shown in the returns quoted above, and the occasional occurrence in large numbers of dangerous malaria-carrying mosquitoes. When in addition to this source of danger from anopheles mosquitoes, one considers the irritation, loss of sleep, and risk of acquiring elephantiasis, dengue, and probably other diseases which are spread by non-malaria carrying species of mosquitoes, it should be realized that legislation for the prevention of mosquito breeding in the town is urgently necessary.

Chief sources of imported Malaria in 1922.

The following are the most important of the sources from which the infection of the imported cases of malaria recorded in the town during 1922 are reported to have been derived :—

(*Statement 18 (c)*).

Locality.	Number of Cases.
Kurunegala	223
Chilaw	134
Anuradhapura	114
Puttalam	69
Polgahawela	57
Negombo	44
Mahara	36
Maho	34
Rambukkana	30
Mirigama	27
Alawwa	26
Matara	24
Ratnapura	23
Talaimannar	19
Veyangoda	18

As regards the local centre of malarial infection in the vicinity of the Victoria park, this is believed to be traceable chiefly to the pond for aquatic plants within the park enclosure, and to the two rainwater catchment pits near the circular drive, all of which have repeatedly been found to be prolific breeding places of *Anopheles sinensis*. The closure of these ponds has been repeatedly urged, and has now been resolved upon, a special vote of Rs. 3,500 having been recently allocated to this purpose.

(12) *Plague*: *136 Cases*; *131 Deaths*; *Case Mortality, 96·3 per Cent.*

Unusual character of Outbreak in 1922.

Although, with the exception of the two years 1918 and 1919, the number of cases of plague recorded during 1922 was smaller than in any other year since the disease first appeared in Colombo in 1914, there were several unusual and interesting features. One of the most striking facts perhaps is that, although the virulence of the disease was proved to be unusually great, there were as stated fewer cases of plague recorded during 1922 than in any previous year, except 1918 and 1919, which were also years of high fatality. At first sight it might naturally be inferred that these very high case mortalities accompanied by low recorded incidence were, as in the case of enteric fever, an indication that a number of mild non-fatal cases had escaped recognition and notification, or had been wilfully concealed. This is however, it is believed, not the true explanation; because non-fatal cases of plague invariably develop buboes, and cannot therefore, as in the case of mild enteric fever, be readily overlooked or mistaken for any other disease; nor can they be easily concealed owing to the buboes. On the other hand, there was certainly no falling off in the thoroughness with which inspection was carried out in 1922; on the contrary, for the reason stated hereafter, house to house inspection was carried out in the infected localities in 1922, with exceptional thoroughness and care. What, however, appears to place this question beyond doubt is the fact recorded by Dr. Hirst in his report, which is annexed, that an unusually virulent strain of plague bacillus appeared in the town, as the result apparently of its having been imported through the agency of rats or fleas, amongst forage. So virulent was this strain that a small dose of it sufficed to kill a 300 grm. Guinea pig within twenty-four hours. The history of this importation is of great epidemiological interest, and is as follows :—

Early in November information was received from the manager of a large forage store in Slave Island that a number of his workmen were absent, some of whom were stated to have died suddenly in their homes in various parts of the town. The investigation which was immediately instituted on receipt of this information disclosed the following facts. An outbreak of unusually virulent plague had suddenly appeared amongst the rats at this forage store, and had, prior to receipt of the information about the human cases, practically wiped out the local rat population, no fewer than fifty-eight dead rats being found by the Public Health Department staff under the bags of forage. On moving this forage, close to which, and in fact amongst which, the workers had been engaged, the floor was seen to be alive with fleas. A dead squirrel which had apparently come down on to this floor from an overhanging tree in search of particles of grain, and was found in the possession of a cat, also proved to have died of plague. An adjoining forage store and some tenements had also been invaded, and seventeen rats killed by the disease. The numerous fleas thus deprived of their natural rat hosts, then attacked the human occupants while they were at work during the day time, with the result that six known cases occurred, in addition to which there were three other cases amongst the workers who had previously been attacked, died, and buried on death certificates giving other and unquestionably incorrect causes of deaths, making a total of nine human cases, all of which proved fatal. The unusual virulence of the infection in this small outbreak was confirmed by Dr. Hirst by animal inoculation as previously stated.

While this investigation was going on, two cases of human plague occurred at Borella, which upon investigation proved to be of the same type as the Slave Island cases, and although the actual mode of transmission could not be ascertained there appears to be no doubt that it had been derived from the same source. It is perhaps unnecessary to say that in the face of such a dangerous type of plague as this, there was no relaxation in the matter of searching for cases and carrying out preventive measures, and it is believed that no case escaped detection after the commencement of the investigation.

The conclusion arrived at in regard to this outbreak was that a new and unusually virulent strain of bacillus pestis had reached the town amongst the imported forage, which was obtained for the most part from India, although a certain amount was said to have come from Australia.

In this connection Dr. Hirst's conclusion that *X. cheopis*, the plague flea of India, is being constantly imported here from India, is of great significance, and calls for the introduction of the special preventive measure recently recommended, viz., fumigation at the port, with Cyanide gas, of all grain and forage imported into the Island.

Subsequent to the outbreak described above, the same type of disease was found amongst the rats in other forage stores and premises adjoining such stores, but, fortunately, no human cases occurred there as thorough preventive measures were at once adopted.

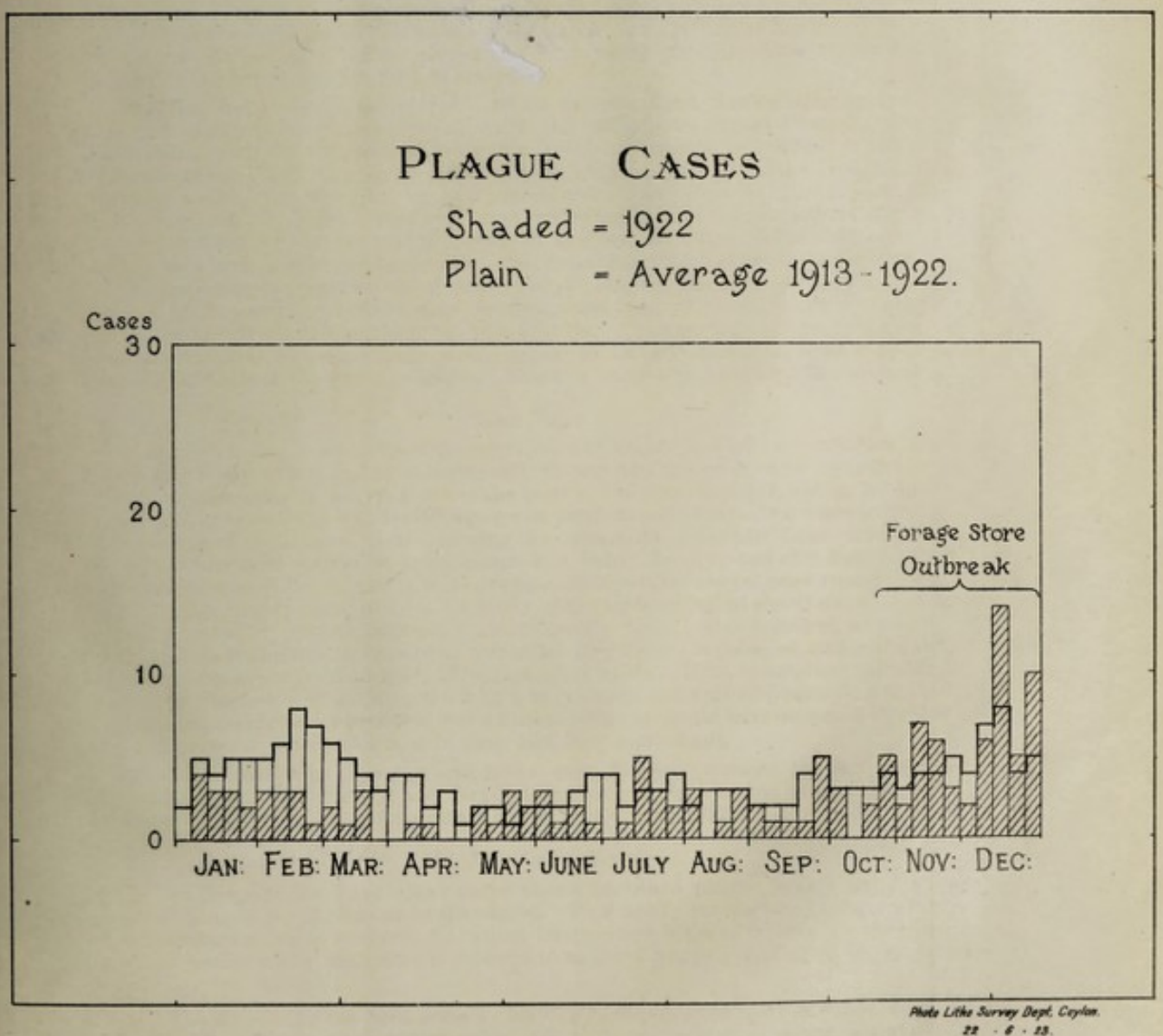
A very interesting fact in regard to this small outbreak is recorded by Dr. Hirst, namely, that it was associated with the prevalence of an unusual species of flea, viz., *ctenocephalus*, several specimens of which were trapped in plague-infected houses, on tanglefoot papers which were spread round cages containing live rats as decoys for fleas. Dr. Hirst also found that this same species of flea had attacked man in Galle during the recent outbreak there. The power of this species of flea to transmit plague amongst rats has, however, not yet been investigated, so that it is not known what part, if any, it played in these outbreaks. This is one of the many interesting problems in connection with plague still awaiting investigation.

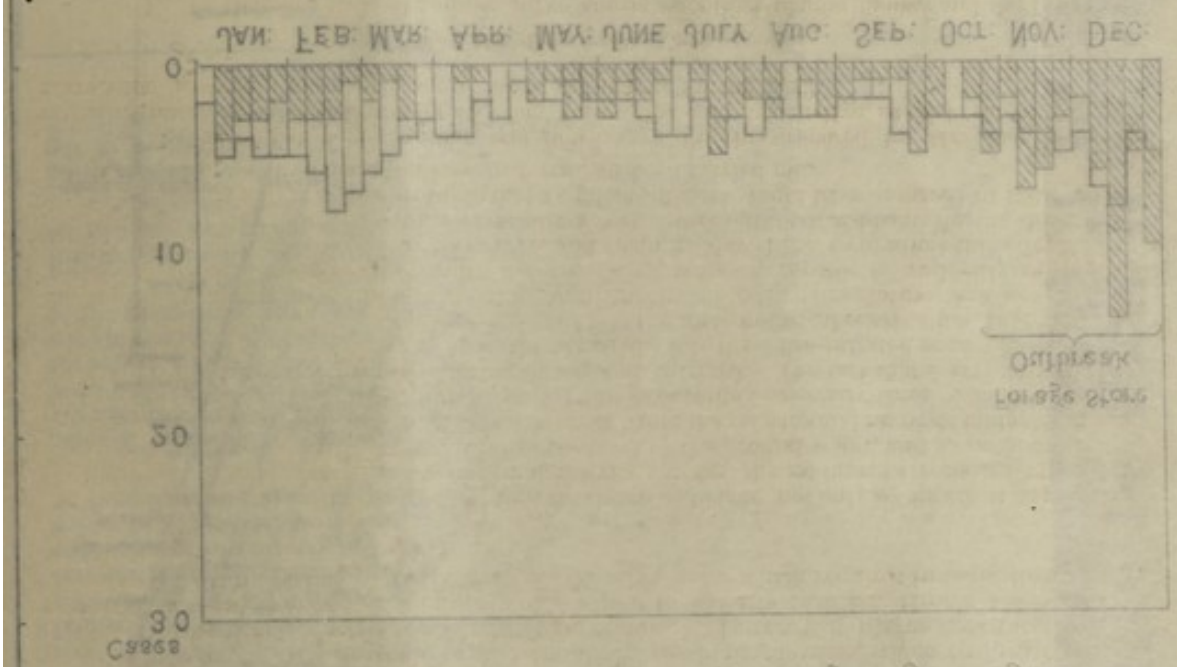
Several specimens of *pulex hominis*—the natural flea of man, and a proved plague carrier, were captured by the Sanitary Inspectors in plague houses, and brought to the Laboratory. For further information as regards the parasitology and bacteriology of plague, reference may be made to Dr. Hirst's very interesting and valuable report annexed.


PLAGUE IN 1922
COLOMBO
SPOT MAP. C.
Scale- 50 Chains to an Inch (R. F. ths.)
Human Cases
Rat Cases
REFERENCE TO WARDS
No
Name
Acres
1
2
3
4
5
6
7
8
9
10
COLOMBO LAKE
TOTAL


PLAGUE IN 1922
COLOMBO
SPOT MAP C.
Human Cases
Rat Cases

Chart, VIII.


PLAGUE CASES
Shaded = 1922
Plain = Average 1913-1922.
Cases
30
20
10
0
Forage Store
Outbreak
JAN: FEB: MAR: APR: MAY: JUNE JULY AUG: SEP: OCT: NOV: DEC:
Photo Litho Survey Dept. Ceylon.
22 - 6 - 23.


JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEP. OCT. NOV. DEC.
0
10
30
CASES

Meteorological Conditions and Plague.

Temperature and humidity.—The records of atmospheric temperature are of special importance in connection with plague in Colombo, for the reason that atmospheric humidity, which has been given such prominence as a factor in connection with plague in India, appears to have little or no influence on the seasonal variations of plague in Colombo, owing, without doubt, to the fact that humidity varies very little here, it is always high and, therefore, favourable to plague at all seasons of the year. Thus, as statement I. (*e*) shows, the average monthly mean humidity in Colombo during the last fourteen years has ranged between 76 and 82 per cent., and seldom goes one way or the other much beyond these narrow limits even for short weekly periods, which is in striking contrast to the climate of many parts of India, where the monthly mean humidity ranges from as low as 30 per cent. or lower, to 90 per cent. in the course of a year, and must therefore exercise a powerful influence on fleas and consequently on plague. Weekly records of temperature, humidity, rainfall, and plague cases, have been kept and charted in this office since plague first appeared in 1914, and a study of these charts clearly shows that the principal meteorological factor as regards seasonal variations of plague in Colombo is not humidity, but atmospheric temperature. Rainfall also has an effect,—sometimes a very sudden and powerful effect—as recorded later under that heading.

As regards the explanation of why low ranges of temperature are favourable, and high temperatures are unfavourable, to outbreaks of plague, a search of the literature on plague, so far as it is available here, does not appear to sufficiently explain the matter. The Indian plague Commissioners and other authorities have, it is true, remarked that temperatures above 80° F. and especially above 85° F. are almost invariably followed by a fall in the number of plague cases, and *vice versâ*, temperatures above 85° generally causing a cessation of the epidemic; they found that these high temperatures have a very unfavourable influence on the *breeding* of fleas, whereas at lower temperatures (provided they are not below 50° F.) fleas breed freely, and rapidly increase in numbers. This no doubt explains to some extent the increase of human plague which has been observed to occur some *three weeks or so after a fall in the temperature* has occurred; but, as the life cycle of a rat flea from egg to full grown insect usually occupies from three to four weeks and is never less than sixteen days, it does not explain the increase which so often occurs here *within about a week* of the temperature falling below 80° F.

Dr. Hirst has recently, as the result of his investigations, thrown light upon this subject by the very important observation that *X. astia*, the indigenous flea of Colombo, does not bite man at all readily until the temperature drops below 80°, and cannot be induced to bite the human skin at temperatures of 85° F. or over; in fact at these higher temperatures the human skin appears to be repellent to the flea; when however the temperature falls below 80° F. a large proportion of starved *X. astia*, will bite man. This flea, on the other hand, bites the rat very readily at tropical temperatures, and but for the fact that it appears to be a very inefficient carrier of plague, it would undoubtedly be a great source of danger here. No exact observations have been made on the effect of different temperatures upon the biting powers of *X. cheopis;* but if a similar effect is produced as in the case of *X. astia*, it would explain the abrupt rise in plague cases, which frequently occurs in Colombo shortly after a fall in the mean temperature. The fact that plague does increase here so quickly after a drop in temperature would appear to indicate that Dr. Hirst's observation in regard to *X. astia* also applies to *X. cheopis*. This is a point which requires investigation.

Rainfall.

Rainfall has an influence upon the prevalence of plague, not only by its effect in reducing the atmospheric temperature, and so inducing activity amongst the rat fleas, as recorded above, but also, when it is exceptionally heavy, it raises the level of the ground water, and so no doubt drives the fleas, which, as is well known, dislike dampness, from the rat runs and rat nests under the floors, up into the rooms of the houses, thus exposing the occupants, especially those who sleep on the floor, to greatly increased danger of being bitten and infected. The fact that heavy rainfall also drives the people who ordinarily sleep in the verandahs into these flea-infested rooms has no doubt a further influence in increasing plague. A study of the meteorological charts since 1914 indicates that ordinary monsoon rainfall, without a simultaneous drop in temperature, has no effect in increasing plague; it appears to require a torrential downpour, capable of suddenly raising the ground water, such as occurred in May, 1916, and again in May, 1922, to produce this effect. The 1916 downpour was followed within a week by a very severe outbreak of plague during the normal plague off-season, and it seems probable that a similar outburst would have occurred in 1922, unless the improved preventive measures now in force had been carried out.

The accompanying diagrams and notes very kindly prepared by Mr. Bamford, the Superintendent of the Observatory, are very interesting and instructive, as they show well the correlation between atmospheric temperature and plague during 1922.

Mr. Bamford's Notes.

1. In Diagram No. 1 the upper curve shows smoothed plague figures and the lower one the smoothed value of the minimum temperatures. To simplify comparisons between the two, the scale of temperature reads downwards, *i.e.*, a low temperature appears further up the paper than a high one, and hence when the curve is referred to as going up, it is equivalent to saying that the temperature is going down.

2. The smoothing has been done by making each point the mean of three weeks, so that the figures of any particular week contribute to each of three consecutive points. Rainfall is shown by vertical columns giving weekly totals without any smoothing.

3. In describing the curves the points are referred to by their dates. This is an abbreviation: a precise description would be "the week ending on the date specified" or in the case of smoothed curves "the mean of three consecutive weeks such that the middle one of the three ends on the date specified."

4. Consider first the smoothed plague and temperature curves. Here there are distinct signs of parallelism though that parallelism is far from being rigid: there is also a distinct hint that a lag of three weeks (probably less rather than more) may be adopted as the mean interval at which peaks in the plague curve follow those in the temperature one.

5. If we examine the temperature curve, point by point, it will be seen that it has an upward loop between January 7 and February 11, which is roughly equivalent to a similar one in the plague curve between January 28 and March 4. A temperature peak on February 25 is followed by a plague peak on March 18, and during the next few weeks there is a general run down in both curves. This reaches its lowest in the temperature curve on April 29, but there is no corresponding drop in the plague curve, which raises an interesting point that will be touched on later.

6. A loop downwards in the temperature curve between May 20 and July 8 is fairly evident in the plague curve three weeks later, and the drop in the temperature curve from July 8 to 29 shows in the plague from July 29 to August 19. The next few weeks do not admit of close correlation beyond the general fact that both curves are low, and on September 30 there is definite rise in the plague curve without any temperature parallelism.

7. A distinct rise in the temperature curve from September 30 to October 21 shows in the plague from October 21 to November 11. The peaks on October 21 and November 11 are probably related, though the plague one is a trifle sharper than is warranted by the temperature alone. After these points there is a check on both curves, which is slightly more pronounced in the plague one, and then a rise in both curves to the end of the year with a hint that under these (colder) conditions the three weeks lag may be shortened somewhat.

8. In dealing with smoothed curves and lags of three weeks, it is probable that we are dealing with the question of how far general conditions are suitable for the development of rats or fleas, but it is probable that we can find a further correlation between the meteorological conditions and the behaviour of the rats (or fleas) already in existence, and such a correlation would probably show in a shorter period than three weeks.

9. In 1922 (unlike 1921) there are two weeks in which the rainfall was over 10 inches. Such rainfall will presumably flood a good many rat holes, and the immediate effect will be to drive rats from comparatively harmless seclusion to the surface. This might be expected to give increased plague almost at once, as it would primarily affect the amount of contact between rats and humans. As far as it effected the general production of rats its effect might be expected to show the three weeks' lag and to be in the opposite direction since some rats might be drowned, and others, driven from the security of their holes, would be killed.

10. Such an expectation fits in well with the figures. The heavy rain shown against May 13 may account for the plague curve keeping up, despite the low temperatures of April 29, by having forced rats that were in hiding to the surface, and at the same time casualities among these rats by drowning or otherwise might help to prevent the temperature peak of May 20 from reappearing on the plague curve.

11. Similarly, the rain of November 11 may explain the points touched on in paragraph 7, *i.e.*, an immediate increase shown in the peak of November 11, and a decrease in three weeks shown in the drop on December 2.

12. The apparent immediate effects of heavy rain naturally raise the question of how far the temperature should be considered in terms of its immediate effect on activity rather than its subsequent effect on production. The smoothed curves do not suggest much connection, but for showing an immediate effect smoothed curves are not particularly suitable, and in Diagram No. 2 unsmoothed weekly values are shown. In it there are two temperature curves, the lower giving the mean of the seven minima during the week and the upper the lowest of those seven. The point of this latter is, that, if there were a sharp effect on activity due to low temperature, a single cold night might cause the trouble even though the other six served to keep the average high.

13. Inspection of Diagram No. 2 does not give much support to the idea of an immediate plague effect due to coldness: the three weeks lag that was apparent here with a distinct hint that it shortens up in the cooler months. In the smoothed curve of plague a mound on September 30 and October 7 appeared to be non-meteorological. It shows up even more strikingly in the unsmoothed curve as a disconnected peak on October 7, and the sharp drop after it, though it comes three weeks after some low temperatures on September 23, is probably due primarily to stringent preventive measures called out by the peak on October 7. Possibly a similar explanation covers the drop in the plague curve on November 25, where the only apparent meteorological support is the effect of heavy rain three weeks earlier as touched on in paragraphs 9 and 11.

14. The biggest outstanding difficulty in examining the relationship of the incidence of plague to climatic variations is undoubtedly the smallness of the plague figures concerned, and under the circumstances one can only hope that this difficulty will continue to restrict the comparison.

A. J. BAMFORD,

Superintendent, Observatory.

Relation of Plague to Race, Sex, and Age.

No race, sex, or age is immune to plague, the relative rate of incidence being controlled by the degree of exposure to infection. It is thus a disease which attacks people who live in rat-infested houses, and whose habits expose them to being bitten by rat fleas; people who sleep upon the floor are thus far more liable to be attacked than those who sleep upon beds. Then, again, people who live in or work in buildings where grain or other kinds of food attractive to rats are stored, are peculiarly liable to attack. A larger proportion of persons are attacked between the ages of fifteen and twenty-five than at any other period of life, while males are three times more liable to attack than females. This again appears to be a question of degree of exposure to infection as explained in section 13 of the report for 1920.

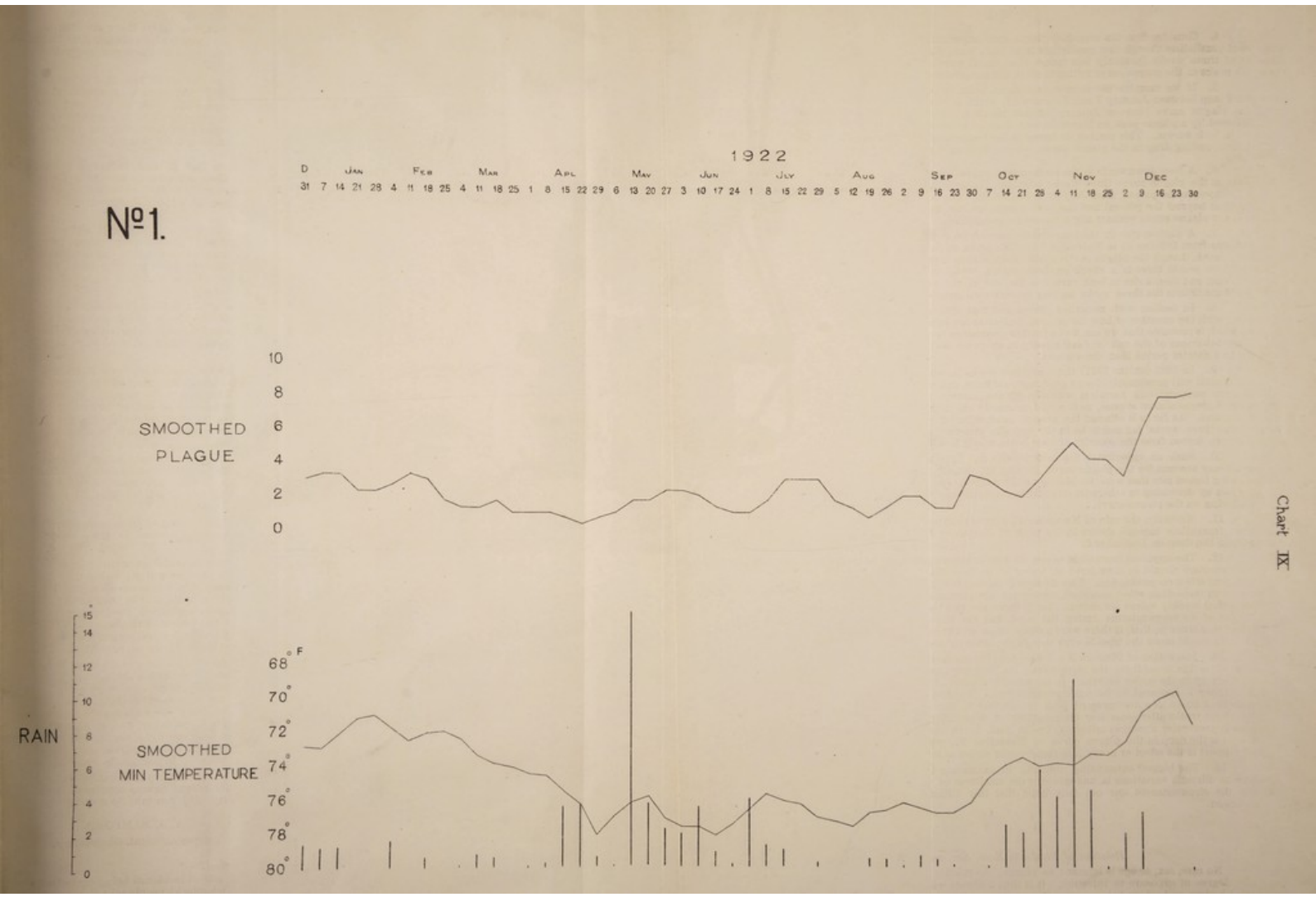
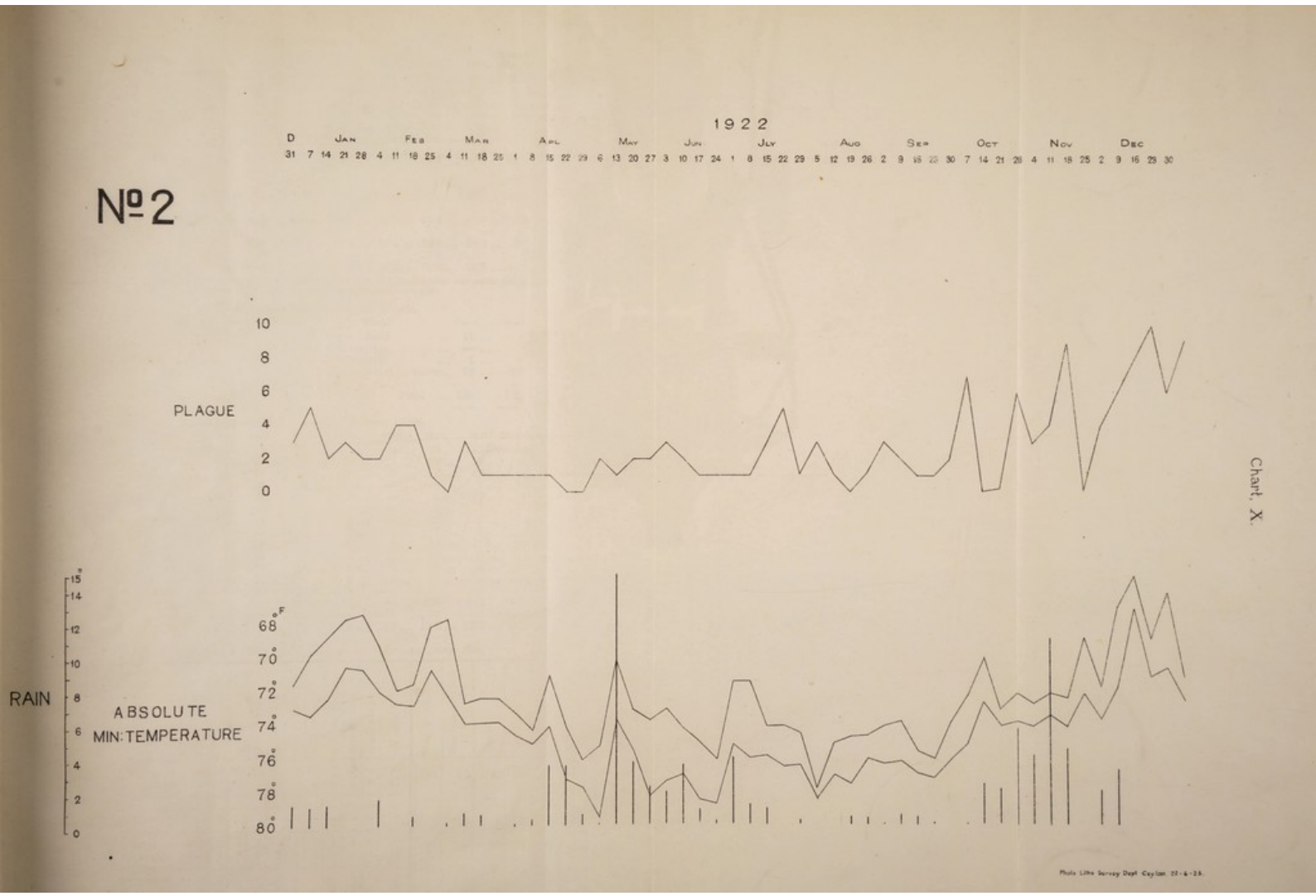

1922
D JAN FEB MAR APL MAY JUN JULY AUG SEP OCT NOV DEC
31 7 14 21 28 4 11 18 25 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9 16 23 30
Nº1.
SMOOTHED PLAGUE
10
8
6
4
2
0
RAIN
SMOOTHED MIN TEMPERATURE
68° F
70°
72°
74°
76°
78°
80°
15
14
12
10
8
6
4
2
0

Chart IX.

No 1.


1922
D JAN FEB MAR APL MAY JUN JLY AUG SEP OCT NOV DEC
31 7 14 21 28 4 11 18 25 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9 16 23 30
№2
PLAGUE
10
8
6
4
2
0
RAIN
ABSOLUTE
MIN: TEMPERATURE
68° F
70°
72°
74°
76°
78°
80°
Chart. X.

Nº 2

PLAGUE

ABSOLUTE
MIN: TEMPERATURE

(19) *Plague.—1914 to 1922.*

	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	Average 1914–1921.	1922.
Total cases	413	139	291	207	70	87	235	184	203	136
Total deaths	381	128	273	196	69	82	223	170	190	131
Septicæmic cases	247*	81*	159	124	41	50	93	70	108	57
Septicæmic deaths	246	80	159	124	41	50	93	70	108	57
Bubonic cases	166	58	132	83	29	37	142	114	95	79
Bubonic deaths	135	48	114	72	28	32	130	100	82	74
Total case mortality per cent.	92·2	92·8	93·8	94·7	98·6	94·3	94·9	92·4	93·6	96·3
Septicæmic case mortality per cent.	99·6	98·7	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Bubonic case mortality per cent.	81·3	82·7	86·4	86·7	96·6	86·5	91·5	87·7	86·3	93·9
Septicæmic cases per cent.	59·8	58·0	54·6	59·9	58·5	57·5	39·6	38·1	53·2	41·9
Bubonic cases per cent.	40·2	42·0	45·4	40·1	41·5	42·5	60·4	61·9	46·8	58·1

* The cases for 1914 and 1915 each includes one septicæmic recovery, but the diagnosis was not in either case confirmed bacteriologically, and may have been erroneous.

(20) *Plague.—Distribution by Wards.*

Ward.	Cases.	Deaths.	Ward.	Cases.	Deaths.
Fort	—	—	Slave Island	11	11
Pettah	20	19	Kollupitiya	—	—
San Sebastian	17	16	Wellawatta	1	1
St. Paul's	26	26	Vagrants and unknown.	19	17
Kotahena	14	14			
New Bazaar	14	13	Total	136	131
Maradana	14	14			

(21) *Monthly Incidence of Plague Cases.*

Month.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1914–1921.	1922.
January	4	19	17	25	13	—	25	65	21	13
February	67	6	18	40	18	1	20	53	28	10
March	58	3	18	61	10	3	3	27	23	6
April	28	3	14	34	11	—	3	7	12	2
May	29	3	11	11	2	—	4	2	8	7
June	49	1	36	3	9	—	3	1	13	8
July	47	5	43	6	2	—	12	3	15	10
August	40	20	35	1	1	2	7	2	13	7
September	18	21	25	3	—	5	18	2	11	7
October	23	24	24	7	—	18	28	9	17	14
November	24	10	25	10	2	34	34	4	18	19
December	26	24	25	6	2	24	78	9	24	33
Total for the year.	413	139	291	207	70	87	235	184	203	136
Monthly mean	34·4	11·6	24·2	17·2	5·8	7·2	19·6	15·3	16·9	11·3

(22) *Plague Cases, 1922—Distribution by Race, Age, and Sex.*

Race.		0 to 5 Years.	5 to 10 Years.	10 to 15 Years.	15 to 20 Years.	20 to 25 Years.	25 to 30 Years.	30 to 35 Years.	35 to 40 Years.	40 to 50 Years.	50 to 60 Years.	60 and over.	All Ages.	Total of each Race.	Case rate per 1,000 Population.	Deaths.	Case Mortality per Cent.	Mortality per 1,000 Population.
All Races	Males	—	6	14	26	24	11	13	10	9	2	—	115†	136	·55	131	96·3	·53
	Females	3	3	2	3	1	3	3	2	—	1	—	21*					
Europeans	Males	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Females	—	—	—	—	—	—	—	—	—	—	—	—					
Burghers	Males	—	—	1	—	—	—	—	—	—	—	—	1	1	·07	1	100·0	·07
	Females	—	—	—	—	—	—	—	—	—	—	—	—					
Sinhalese	Males	—	2	2	4	5	—	1	3	1	1	—	19	32	·28	30	93·8	·27
	Females	2	—	1	3	1	2	2	2	—	—	—	13					
Tamils	Males	—	2	7	13	12	7	7	5	2	—	—	55	63	1·15	60	95·2	1·09
	Females	1	3	1	—	—	1	1	—	—	1	—	8					
Moors	Males	—	2	4	6	7	2	4	2	5	1	—	33	33	·82	33	100·0	·82
	Females	—	—	—	—	—	—	—	—	—	—	—	—					
Malays	Males	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Females	—	—	—	—	—	—	—	—	—	—	—	—					
Others	Males	—	—	—	3	—	2	1	—	1	—	—	7	7	·57	7	100·0	·57
	Females	—	—	—	—	—	—	—	—	—	—	—	—					

† 0·77 per 1,000 males. * 0·22 per 1,000 females.

Rat Plague.—Out of a total of 33,827 rats examined during the year, 57 or 0·17 per cent. were proved to be plague infected, as against an infection rate of 0·20 per cent. in 1921. 206 mummified and 204 recently dead rats were found, including 12 infected, and 87 dead rats found in or near forage stores, where, as recorded above, an unusually virulent epizootic had practically decimated the rat population during October-November.

Plague amongst Cats and Squirrels.—Three plague-infected cats were found in 1917, one in 1919, and two in 1922. In each case there were large sublingual buboes pointing to infection having been acquired by eating septicæmic rats. An infected squirrel was found in 1922 in one of the plague-infected forage stores referred to earlier, where it had probably been infected while on the ground in search of grain. No fleas have so far been found upon the squirrels examined by Dr. Hirst, which is in itself reassuring.

Preventive Measures.—(See section 19.)

(23) *Rat Destruction. All sources.*

	1921.	1922.
Number of rats trapped ...	157,709	172,429
Number of rats killed by Claytons ...	5,046	2,738
Number of rats found dead ...	331	204
Number of mummified rats found ...	195	206
Total ...	163,281	175,577

(24) *Statement furnished by the Municipal Veterinary Surgeon showing the Number of Rats trapped and found dead during 1922.*

Month.	No. of Rats trapped.	No. of Rats found dead.	Total.
January ...	16,482	4	16,486
February ...	14,811	6	14,817
March ...	15,138	8	15,146
April ...	15,174	—	15,174
May ...	15,553	—	15,553
June ...	15,173	—	15,173
July ...	14,249	4	14,253
August ...	13,722	6	13,728
September ...	13,926	3	13,929
October ...	14,767	3	14,770
November ...	10,776	13	10,789
December ...	12,658	5	12,663
Total ...	172,429	52	172,481

(25) *Statement showing Rats examined at the Laboratory, number found infected, and percentage infection.*

Month.	No. of Rats Examined.	No. Infected.	Percentage Infection.
January ...	2,843	9	0·32
February ...	3,200	1	·03
March ...	2,222	2	·09
April ...	1,985	—	—
May ...	2,088	—	—
June ...	3,950	5	·13
July ...	3,022	8	·26
August ...	2,949	—	—
September ...	3,129	3	·10
October ...	3,192	1	·03
November ...	2,829	16*	·57
December ...	2,418	12	·50
Total ...	33,827	57	·17

* Inclusive of one rat examined at the Government Bacteriological Laboratory.

(26) *Rats trapped killed by Claytons and found dead.*

Month.	Rats trapped (Veterinary Surgeon).	Rats killed by Claytons.	Mummified Rats (Plague Inspector).	Dead Rats (Veterinary Surgeon).	Dead Rats (Plague Inspector).
January ...	16,482	309	13	4	12
February ...	14,811	257	6	6	14
March ...	15,138	185	3	8	4
April ...	15,174	238	4	—	1
May ...	15,553	291	9	—	3
June ...	15,173	288	34	—	42
July ...	14,249	170	20	4	7
August ...	13,722	219	7	6	13
September ...	13,926	217	16	3	17
October ...	14,767	242	5	3	4
November ...	10,776	166	73	13	23
December ...	12,658	156	16	5	12
Total ...	172,429	2,738	206	52	152

(27) *Work done by the Plague Staff during 1922.*)

Ward.	Dwellings Claytonized.	Rat-holes Claytonized and filled up.	Rats killed by Claytons.	Recently dead Rats found.	Mummified Rats found.	Cart-loads of rubbish removed.	Rat-nests found.	Dwellings unroofed.	Dwellings pesterined.	Houses disinfected.
Fort ...	26	13	2	10	—	7	—	15	15	11
Pettah ...	615	1,882	366	39	39	221½	19	333	174	441
St. Paul's ...	2,340	6,163	555	13	20	351½	28	1,960	1,376	962
San Sebastian ...	961	2,830	210	8	13	113	7	731	685	276
Kotahena North ...	567	1,566	143	50	39	296	19	506	345	222
Kotahena South ...	1,176	3,437	254	3	7	213	18	1,062	947	229
New Bazaar ...	1,375	4,196	310	1	9	382	24	1,140	927	448
Maradana North ...	358	1,342	95	3	1	65	3	295	239	119
Maradana South ...	1,263	2,859	308	3	4	245	19	1,113	686	577
Maradana East ...	25	54	2	—	—	1	—	25	25	—
Slave Island ...	1,992	5,474	363	21	73	233½	26	1,678	1,566	426
Colpetty ...	25	235	88	—	1	1	—	6	2	23
Wellawatta North ...	1	6	—	—	—	—	—	1	1	—
Wellawatta South ...	247	895	42	1	—	45	19	243	127	120
	10,971	30,952	2,738	152	206	2,174½	182	9,108	7,117	3,864

13.—Smallpox.

Town cases, 34 ; Port cases, 7 ; outside cases, 1 ; total, 42 cases ; total deaths 6.

This disease was imported into Colombo from India on no less than eight different occasions during the year, the patient having in each case arrived during the incubation period and developed the disease in the town. It is a testimony to the good work done by the Sanitary Inspectors that only one of these cases, a very modified case which escaped recognition by the medical practitioner in attendance, gave rise to a series of fourteen further cases in the town.

14.—Vaccination.

Some idea of the thoroughness of vaccination in Colombo will be obtained from the fact that although 6,881 births were recorded during the year, 7,240 primary vaccinations and 9,461 re-vaccinations were performed, to which must be added 364 vaccinations performed by the Public Health Department staff on behalf of the Military medical authorities, making a total of 17,065 vaccinations performed during the year, of which no less than 9,599 were performed by the Municipal staff.

(28) *Vaccination performed during 1922.*

(*a*) By Government Vaccinators.

Ward.	Primary Vaccination.	Re-vaccination.	Total.
Fort, Galle Face, Pettah, and San Sebastian ...	559	13	572
St. Paul's ...	710	37	747
Kotahena ...	1,088	38	1,126
New Bazaar ...	744	23	767
Maradana ...	672	1,426	2,098
Slave Island ...	753	63	816
Kollupitiya ...	1,016	21	1,037
Wellawatta ...	870	56	926
Itinerating (Colombo) ...	377	—	377
Total ...	6,789	1,677	8,466

(*b*) By Municipal Vaccinators.

Ward.	Primary Vaccination.	Re-vaccination.	Total.
Fort ...	—	—	—
Pettah ...	1	46	47
San Sebastian ...	17	368	385
St. Paul's ...	—	13	13
Kotahena ...	2	21	23
New Bazaar ...	1	15	16
Maradana ...	187	3,342	3,529
Slave Island ...	188	3,099	3,287
Kollupitiya ...	8	271	279
Wellawatta ...	47	609	656
Total ...	451	7,784	8,235

In addition to the above figures there were 364 vaccinations performed at the Military Quarters.

Total Vaccinations in Colombo = 17,065.

MISCELLANEOUS DISEASES.

Chickenpox.—699 cases, no deaths. This mild disease was, as usual, very prevalent, especially during February, March, and April. The chief danger associated with it is that it is sometimes almost undistinguishable from modified smallpox.

Measles.—226 cases, 1 death. The mortality ascribed to measles is without doubt an under-statement, as a number of deaths of children which were ascribed to bronchitis, convulsions, &c., were probably primarily due to an attack of measles.

Diphtheria.—16 town cases; 3 outside cases; 7 deaths. This disease is seldom prevalent in the tropics. Cases of Vincent's Angina are known to occur in Colombo, and may occasionally be mistaken for diphtheria.

Rabies.—Four deaths from hydrophobia were recorded during the year.

Tetanus.—71 deaths.

Syphilis.—69 deaths.

Part II.—Administration.

In accordance with instructions contained in Chairman's letter No. 4s of January 9, 1923, the following brief description is submitted of "the organization of each branch of the work (of the Public Health Department), the numbers of the staff employed thereon, and the method of work, together with details as to the plant, equipment, &c., available at the end of 1922."

The description of the methods of work in a department with such mainfold duties as the Public Health Department is necessarily very incomplete, as will be realized by an examination of the statements giving the details of the work carried out by the department during the year.

15.—ORGANIZATION OF PUBLIC HEALTH DEPARTMENT.

The general scheme of organization of the Public Health Department is graphically depicted on the accompanying diagram.

For the purposes of administration by the Public Health Department, the town is divided into the following areas:—

16.—ADMINISTRATION AREAS.

1. Two Assistant Health Officers Divisions.
2. Fourteen Sanitary Inspectors' Wards.
3. Five Sub-Inspectors' Divisions.
4. Five Mosquito Overseers' Blocks.
5. Four Dispensary Divisions.
6. Seven Midwives' Districts.
7. Six Birth and Death Registration Divisions.

The Medical Officer of Health as Head of the department is in supreme charge of the whole department and all its branches.

(1) *Assistant Health Officers' Divisions.*

The town as a whole is divided into two Assistant Health Officers' Divisions, viz., South and North, by a line passing through the main lake and along the San Sebastian Canal. These divisions are much too large, but, as there are only two Assistant Health Officers and no District Health Officers on the staff, as there are in towns such as Calcutta and Bombay, there is no alternative to dividing the town for administrative purposes between the two assistants. This arrangement necessarily throws an immense amount of petty detail work upon the Medical Officer of Health himself.

The Senior Assistant Medical Officer of Health is in charge of all work in the South Division, except infectious diseases. He also deals with buildings (structural work), in so far as the Public Health Department is concerned, in both South and North Divisions.

The Junior Assistant Medical Officer of Health is in charge of all work in the North Division, except buildings (structural work). He is also in charge of infectious diseases in both North and South Divisions.

(2) *Sanitary Wards.*

The town is further sub-divided into fourteen Sanitary Inspectors' wards, seven in each Assistant Medical Officer of Health's division, one Sanitary Inspector being in charge of each ward as follows:—

South Division Wards.—Wellawatta South and North, Colpetty, Slave Island, Maradana South, North, and East.

North Division Wards.—Fort, Pettah, St. Paul's, San Sebastian, New Bazaar, Kotahena North and South.

(3) *Sub-Inspectors' Divisions.*

The fourteen sanitary wards are grouped into five Sub-Inspectors' divisions with a Sub-Inspector attached to each as follows:—(1) Wellawatta South and North; (2) Fort, Pettah, Slave Island; (3) St. Paul's, Kotahena South and North; (4) San Sebastian, New Bazaar; (5) Maradana South, North, and East.

(4) *Mosquito Overseers' Blocks.*

Following the arrangement initiated by Major James, I.M.S., a portion of the town is divided into five blocks as shown upon the accompanying map. In the portions of the town not included within these blocks, only specific complaints of mosquito nuisance and cases of locally-acquired malaria are dealt with.

(5) *Dispensary Divisions: Situation, Staff.*

For the purposes of Medical Relief and Maternity and Child Welfare, four free Municipal Dispensaries are established in the poorest areas of the town, as shown upon the accompanying map. The situation, area served, and staff of each is as follows:—

(*A*)—*Slave Island Dispensary.*

Situation: 44, Union place.

Area served: Slave Island and Polwatta.

Staff: One Medical Officer in charge, one Apothecary, one Orderly, three Health Visitors, one Midwife.

PUBLIC HEALTH DEPARTMENT
SCHEME OF ORGANIZATION

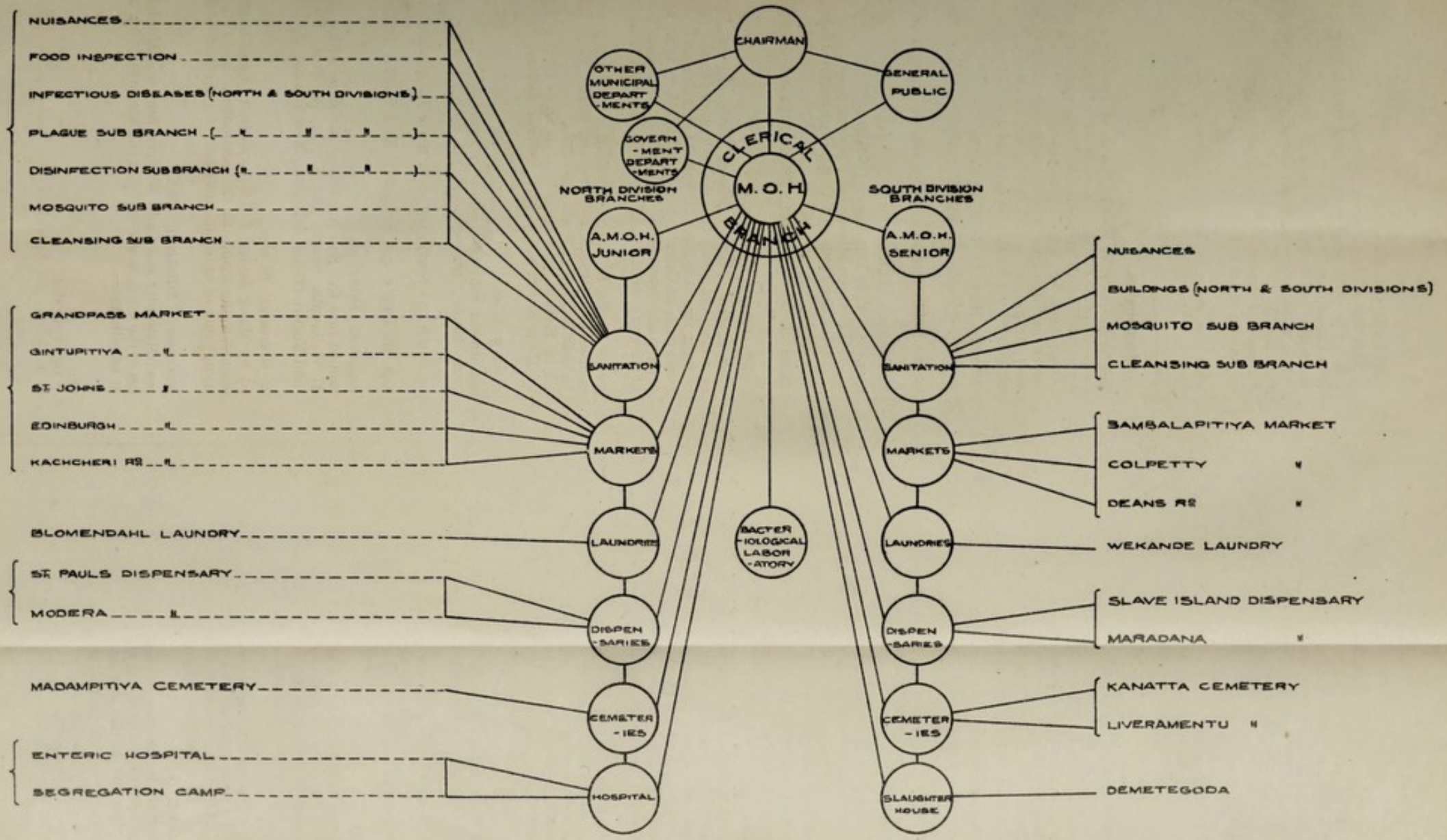
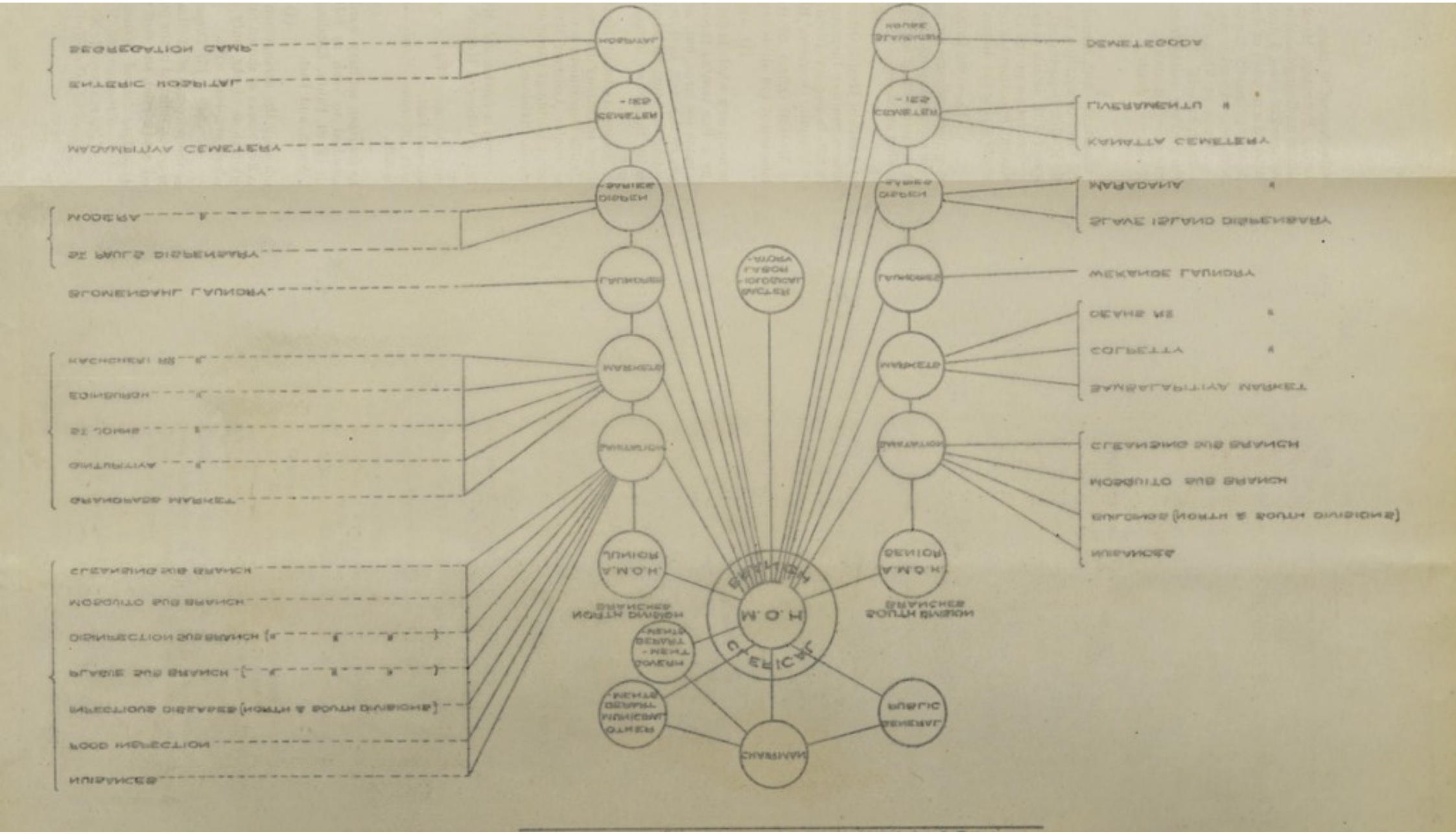
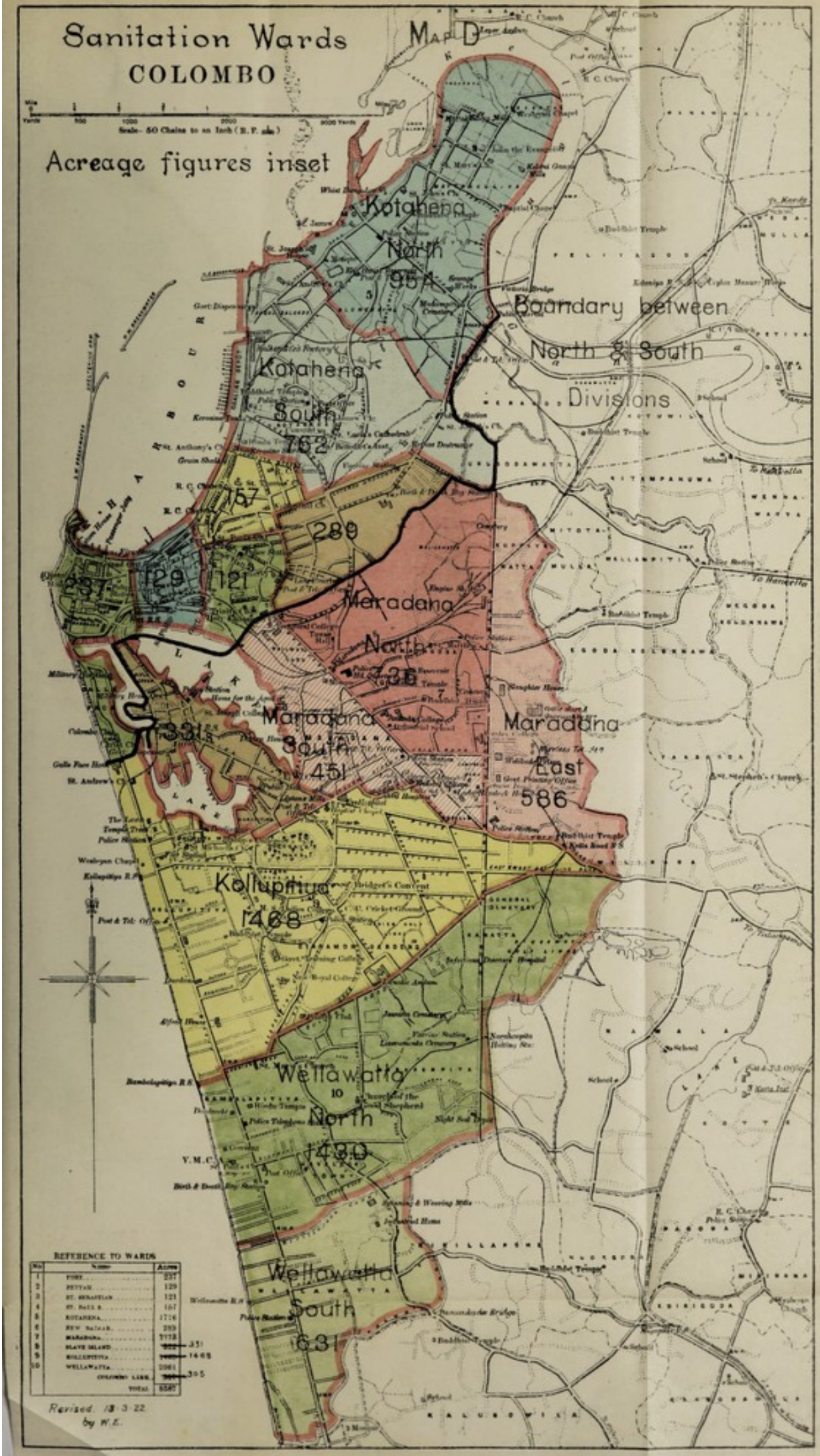
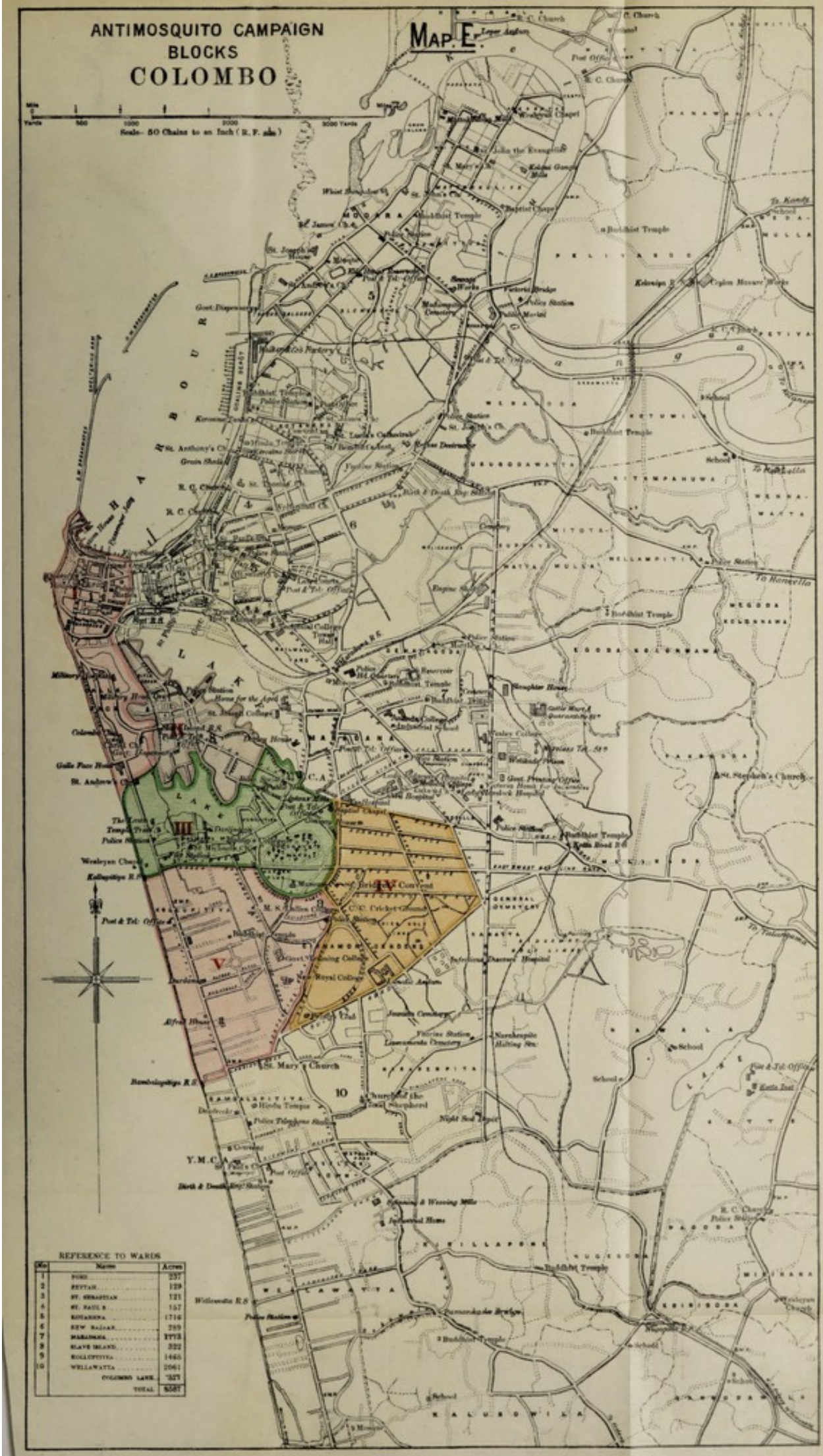


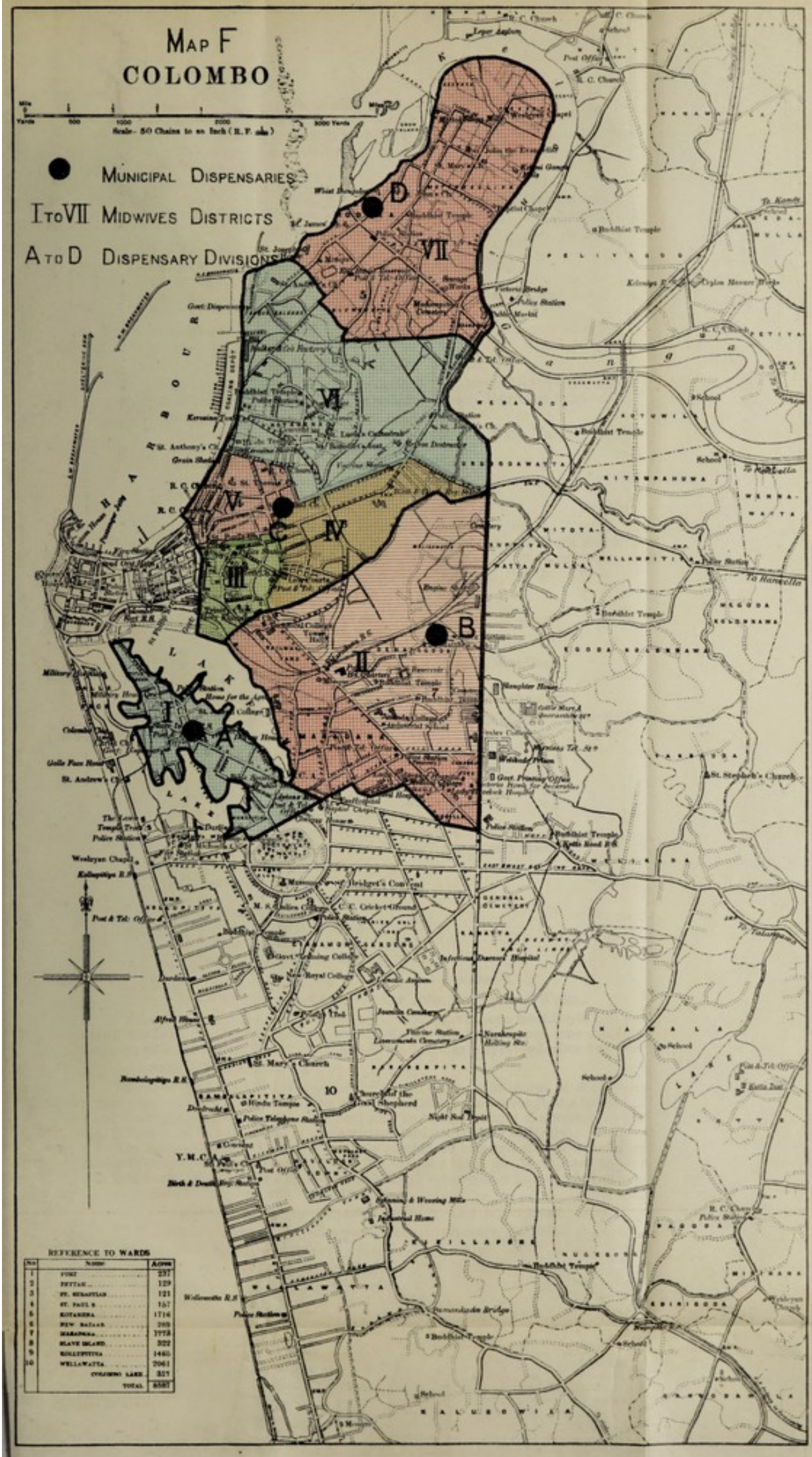
Photo Litho. Survey Dept: Ceylon. 8-6-23.

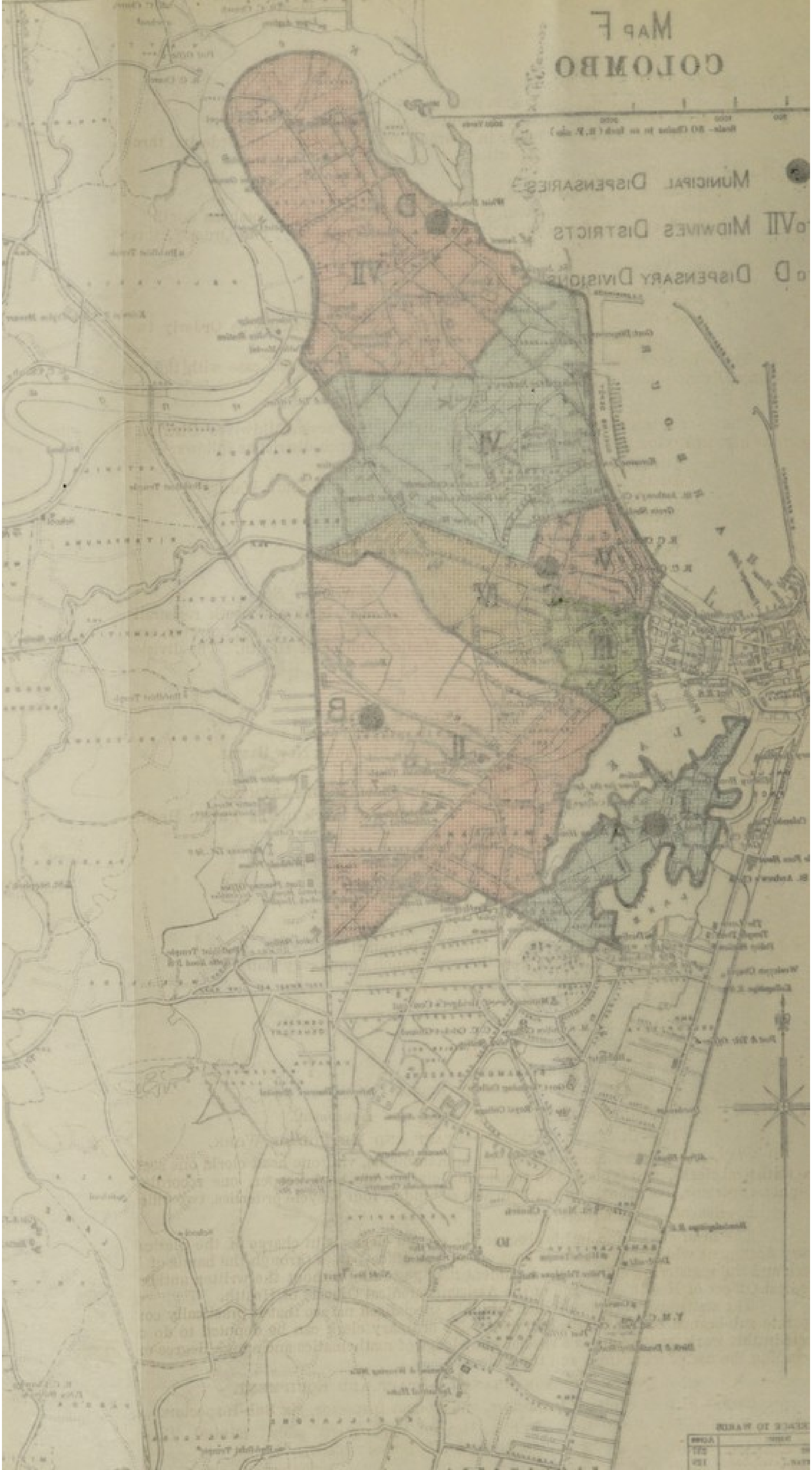



Sanitation Wards
COLOMBO
MAP D
Acreage figures inset
Kotahena North 951
Kotahena South 752
Boundary between North & South Divisions
157
289
237
129
121
Maradana North 736
Maradana South 451
Maradana East 586
331
Kollupitiya 1468
Wellawatta North 1480
Wellawatta South 631
REFERENCE TO WARDS
Revised. 13-3-22 by W.E.


ANTIMOSQUITO CAMPAIGN
BLOCKS
COLOMBO
MAP E.
Scale- 50 Chains to an Inch (R. F. abt.)
REFERENCE TO WARDS
No. Name Acres
1 FORT 237
2 PETTAH 129
3 ST. SEBASTIAN 121
4 ST. PAUL'S 157
5 KOTAHENA 1716
6 NEW BAZAAR 289
7 MARADANA 1713
8 SLAVE ISLAND 322
9 KOLLUPITIYA 1465
10 WELLAWATTA 2061
COLOMBO LAKE 327
TOTAL 8537


MAP E.
ANTIMOSQUITO CAMPAIGN
BLOCKS
COLOMBO
I
II
III
IV
V
REFERENCE TO WARDS


MAP F
COLOMBO
Scale- 80 Chains to an Inch (R.F. 1/5)
MUNICIPAL DISPENSARIES
I TO VII MIDWIVES DISTRICTS
A TO D DISPENSARY DIVISIONS
REFERENCE TO WARDS
No. Name Acres
1 FORT 237
2 PETTAH 129
3 ST. SEBASTIAN 121
4 ST. PAUL'S 157
5 KOTAHENA 1716
6 NEW BAZAAR 289
7 MARADANA 1773
8 SLAVE ISLAND 322
9 KOLLUPITIYA 1465
10 WELLAWATTA 2961
COLOMBO LAKE 325
TOTAL 8587



Map F
COLOMBO
Municipal Dispensaries
VII Midwives Districts
D Dispensary Divisions

(*B*)—*Maradana Dispensary.*

Situation: 103, Dematagoda road.
Area served: Maradana North and South.
Staff: One Medical Officer in charge, one Apothecary, one Orderly, three Health Visitors, one Midwife.

(*C*)—*St. Paul's Dispensary.*

Situation: 9, Barber street.
Area served: San Sebastian, New Bazaar, St. Paul's, and Kotahena South.
Staff: One Medical Officer in charge, one Apothecary, one Orderly, three Health Visitors, four Midwives.

(*D*)—*Modera Dispensary.*

Situation: 38B, Modera street.
Area served: Kotahena North.
Staff: One Medical Officer in charge, one Apothecary, one Orderly two Health Visitors, one Midwife.

The area assigned to the Health Visitors corresponds in each case with the area of the Dispensary Division to which they are attached.

(6) *Midwives' Districts. Seven.*

The four Dispensary Divisions are sub-divided into seven Midwives' Districts as shown upon the accompanying map, one midwife being assigned to each district as follows:—

Division A, District I.—Slave Island Ward.
Division B, District II.—Maradana North and South Wards.
Division C, District III.—San Sebastian Ward.
Division C, District IV.—New Bazaar Ward.
Division C, District V.—St. Paul's Ward.
Division C, District VI.—Kotahena South Ward.
Division D, District VII.—Kotahena North Ward.

(7) *Birth and Death Registration Divisions. Six.*

These divisions are fixed by law for the purposes of birth and death registration. The Registrars are all medical men and are under the Registrar-General. They, however, send weekly returns of all births and deaths registered to the Medical Officer of Health. The divisions are as follows:—

Division I.—Fort Ward.
Division IIA.—Slave Island and Colpetty.
Division IIB.—Wellawatta North and South.
Division III.—Maradana North, South, and East.
Division IV.—Pettah, San Sebastian, St. Paul's, New Bazaar.
Division V.—Kotahena North and South.

17.—Branches of the Public Health Department.

There are nine branches and four sub-branches of work in the Public Health Department, each with its own staff and equipment as follows:—

(*a*) Clerical Branch.
(*b*) Sanitation Branch.

Sanitation Sub-Branches.

(1) Mosquito prevention sub-branch.
(2) Disinfection prevention sub-branch.
(3) Cleansing prevention sub-branch.
(4) Plague prevention sub-branch (temporary staff).

(*c*) Markets Branch.
(*d*) Laundries Branch.
(*e*) Dispensaries Branch.
(*f*) Cemeteries Branch.
(*g*) Enteric Hospital Branch.
(*h*) Slaughter-house Branch.
(*i*) Bacteriological Laboratory Branch.

Staff, Method of Work, and Equipment.

18.—Clerical Branch.—Staff and Method of Work.

Staff.—Ten clerks and twelve minor appointments, viz., one head clerk, one second clerk, two statistical clerks, two typists, two registering clerks, one book-keeper, one recordkeeper, one telephone operator, five peons, one of whom acts as binder, four bicycle orderlies, two office coolies.

Equipment.—Typewriters, &c.

The head clerk, and in his absence the second clerk, is in charge of the Clerical Branch; every document which comes into or goes out of the office passes through the hands of both head clerk and the registering clerk. No document may go to file without the written authority of the Medical Officer of Health or of one of the Assistant Medical Officers of Health.

The statistical work is of such a highly specialized nature that it practically constitutes a separate sub-branch of the Clerical Branch. No ordinary clerk can be deputed to do or even to assist in this work, as it requires a special knowledge of mathematics and a high degree of training, including the use of logarithms and the slide rule.

19.—Sanitation Branch.—Staff and Equipment.

Staff.—Fifteen Sanitary Inspectors, one woman Inspector, six Sub-Inspectors.

Equipment.—Brief bags, Public Health Department seals, clinical thermometers, lanterns, tape boxes, vaccination lances, spirit lamps, police whistles.

(1) *Mosquito prevention Sub-Branch.*

Staff.—Six overseers, twelve coolies.

Equipment.—One 35 feet extension ladder on carriage, one full-sized mosquito trap, larva nets, dippers, saucepans, spoons, mamoties, baskets, oil drums, liquid fuel, kerosine, cyllin.

(2) *Disinfection Sub-Branch.*

Staff.—One overseer, thirteen coolies.

Equipment.—One Equifex steam disinfector, six disinfecting foot pumps, buckets, mops, measure glasses, cyllin.

(3) *Cleansing Sub-Branch.*

Staff.—One overseer, four coolies. To these must be added two temporary plague coolies included below in the staff of the plague sub-branch.

Equipment.—One disinfecting foot pump, mamoties, rakes, pickaxes, shovels, crowbar, buckets, oil drums, baskets, cyllin. A bullock cart is hired as required.

(4) *Plague Sub-Branch (temporary).*

Staff.—One Inspector, six overseers, nine masons, fifty-seven coolies (two attached to cleansing gang).

Equipment.—Six petrol driven, eight hand driven, and six miniature Clayton fumigators, twelve hand carts, mamoties, rakes, spades, buckets, oil drums, mops, brooms, liquid fuel, kerosine, cyllin, cement, lime, sand. A cart is hired as required.

Four hand driven and five miniature Claytons were received at the end of the year and are included above.

Sanitation Branch.—Scope of Work.

Sanitation is necessarily much the most important branch of work of the Public Health Department, including as it does the innumerable and responsible duties involved in the following:—

(*a*) *Prevention of nuisances* in public and private premises, which entails constant inspection all over the town.

(*b*) *Prevention of insect pests*, viz., mosquitoes, flies, copra beetles, &c. Mosquito prevention is such a highly specialized class of work that, as already stated, it forms a distinct sub-branch which is dealt with later.

(*c*) *Prevention of infectious diseases*, including the detection and isolation of cases and contacts, vaccination of smallpox contacts, and the disinfection of infected articles and premises. Disinfection and plague prevention which come under this heading form two more or less distinct sub-branches as stated above.

(*d*) *Inspection, seizure, and sampling of food*, milk, water, aerated waters, &c. This ought to be a separate sub-branch, but there are no special Food Inspectors on the staff.

(*e*) *Inspection and control over markets*, dairies, bakeries, laundries, public bathing places, eating-houses, common lodging houses, grain and other stores, shops, and boutiques, offensive trades, &c.

(*f*) *Institution and conducting of prosecutions* for breaches of the sanitary laws, involving a thorough knowledge of the Public Health enactments. This work ought to be carried out by a chief Sanitary Inspector, but there is no such officer on the staff.

(*g*) Occasional and sometimes very heavy duties, in connection with such matters as food control, inquiring into and reporting upon employment and distress, and relief of distress in time of flood, riots, trade depression, &c. These do not form the proper duties of a Sanitary Inspector, but are generally thrust upon Public Health Department for the reason no doubt that the Sanitary Inspectors are a highly trained and efficient body of officers, accustomed to deal with the public.

No other class of Municipal Officer has such a multitude and variety of responsible duties to perform, as the Sanitary Inspectors, duties for the efficient performance of which the following qualifications are required, viz., good social standing to support him in his domiciliary visitations, good physique to enable him to cope with the heavy outdoor work, courage to fit him for dealing with opposition, good education, sound common sense, a quiet manner, great tact, inexhaustible patience and forbearance, and incorruptible honesty. Such are the characteristics of an ideal Sanitary Inspector, and which the officers of the Public Health Department are constantly urged to endeavour to live up to.

Sanitation Branch.—Method of Work.

The work of a Sanitary Inspector begins at 7 A.M. and ceases at 4·30 P.M., or later, if he has any special work in hand. He is also liable to be called out on duty at any hour in connection with infectious diseases. The work of the Sanitary Inspectors is of two classes, routine and special. The mornings are devoted to routine work, *i.e.*, systematic house-to-house inspection, unless there is urgent special work, to attend to, such as dangerous infectious diseases, *e.g.*, plague, cholera, or smallpox. Reports are written up from 1·30 to 3 P.M., in the office, while the rest of the afternoon is spent on special outdoor work, such as inspection of dairies, bakeries, laundries, &c. The Sanitary Inspectors exercise general supervision and controli n respect of the four sub-branches of work previously mentioned, viz., mosquito prevention, disinfection, cleansing, and plague prevention, in so far as such work lies within their respective wards.

Work of Sub-Inspectors.

Sub-Inspectors assist the Sanitary Inspectors with their work generally, and are also in direct charge of the less dangerous infectious diseases, such as phthisis, enteric, continued fever, chickenpox, measles, and diphtheria, in respect of which they are responsible for the work of investigation, isolation, and disinfection. Details of the work done by the Inspectors and Sub-Inspectors in 1922 are given in statements 29 to 34.

The sixth and generally the most junior Sub-Inspector is in charge of the mosquito prevention sub-branch described below. Every Sub-Inspector must take his turn at this work before he is eligible for promotion to Sanitary Inspector.

(29) *Work done by Sanitary Inspectors and Sub-Inspectors during 1922.*

Nature of Work.	Fort.	Pettah.	San Sebastian	St. Paul's	Kotahena North.	Kotahena South.	New Bazaar.	Maradana North.	Maradana South.	Maradana East.	Slave Island.	Kollupitiya.	Wellawatta North.	Wellawatta South.	Total.
1. Number of inspections	3,147	4,496	3,174	2,975	4,688	3,857	3,734	3,565	5,102	2,324	3,106	2,888	3,725	7,265	54,046
2. Number of premises in which sanitary defects were found (*a*) non-structural	147	167	191	212	161	293	308	470	251	368	317	271	150	274	3,540
3. Number of premises in which sanitary defects were found (*b*) structural	42	32	123	128	41	75	37	204	63	78	140	92	46	8	1,109
4. Number of premises where non-structural defects were rectified.	125	124	153	81	104	188	291	279	109	330	108	63	88	229	2,272
5. Number of premises where structural defects were rectified ...	5	36	48	21	17	39	30	77	52	34	56	33	28	4	480
6. Number of insanitary dwellings structurally improved ...	8	4	7	11	17	1	—	5	9	30	2	—	20	—	114
7. Number of buildings other than dwellings, structurally improved.	26	41	68	43	19	26	6	199	50	37	15	27	25	7	589
8. Number of insanitary dwellings closed under Plague Regulations.	—	—	30	—	—	—	—	39	15	—	—	—	—	—	84
9. Number of insanitary dwellings remaining closed at end of year.	—	1	38	48	52	—	—	39	15	—	—	—	—	—	193
10. Number of insanitary dwellings demolished	—	—	—	—	—	—	—	22	—	—	—	—	—	—	22
11. Number of insanitary premises in which plans have been called for.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12. Number of insanitary dwellings included in 11 ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13. Number of insanitary premises in which plans have been received.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14. Number of insanitary premises condemned and referred to Works Engineer for improvement	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15. Number of insanitary dwellings included in 14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16. Number of insanitary premises scavenged by Public Health Department Cleansing Gang	—	28	26	222	1,031	1,339	131	1,446	417	176	68	41	19	10	4,954
17. Number of dwellings pesterined...	15	174	685	1,376	345	947	927	239	686	25	1,566	2	2	127	7,116
18. Number of dwellings claytonized	26	525	961	2,400	576	1,176	1,375	358	1,263	25	1,992	25	1	245	10,948
19. Number of dwellings unroofed	15	333	731	1,960	506	1,062	1,140	295	1,113	25	1,678	6	1	243	9,108
20. Number of rat-holes found claytonized and filled up ...	13	1,882	2,830	6,163	1,566	3,437	4,196	1,342	2,859	54	5,474	235	6	895	30,952
21. Number of dwellings disinfected	12	354	318	1,027	294	331	531	248	443	24	536	98	91	161	4,468
22. Number of dwellings limewashed	111	216	550	1,591	194	433	867	475	359	768	777	61	161	77	6,531
23. Number of wells filled up	—	—	—	—	—	—	—	7	3	3	—	3	2	—	18
24. Number of cesspits filled up	—	2	12	23	16	35	24	15	2	—	—	2	8	3	142
25. Number of notices served under section 1, sub-section (1), of Ordinance No. 15 of 1862. (Filthy premises) ...	5	23	99	82	29	132	98	201	124	53	126	48	44	35	1,099
26. Number of notices served under section 186 of Ordinance No. 6 1910. (Privy accommodation)	—	—	—	—	3	7	—	1	—	3	—	—	2	1	17
27. Number of notices served under section 189 of Ordinance No. 6 of 1910. (Filling up of stagnant pools, &c.) ...	—	—	—	—	2	—	—	3	—	—	—	5	—	—	10
28. Number of notices served under section 178 of Ordinance No. 6 of 1910. (Cleansing and limewashing)	17	41	66	104	27	69	68	133	68	78	82	42	81	23	899
29. Number of notices served under section 49, Part I. of Plague Regulations. (Closure of buildings unfit for human habitation)	—	—	32	—	—	—	—	41	17	—	—	—	—	—	90
30. Number of notices served under By-law 8 (1), chapter XXII. (Improvement to buildings unfit for human habitation ...	4	—	3	1	—	1	—	1	—	—	—	—	—	—	10
31. Number of notices served under section 38, Part I. of Plague Regulations. (Filling up of wells)	—	—	—	—	—	—	—	10	—	3	3	3	—	—	19
32. Number of notices served under section 39, Part I. of Plague Regulations. (Over-crowding)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33. Number of prosecutions	74	165	236	189	113	181	239	199	147	130	178	145	100	117	2,213
34. Number of convictions	65	153	210	172	108	151	212	158	133	111	160	129	94	103	1,959
35. Number of cases acquitted, withdrawn, or otherwise dealt with...	—	5	15	13	4	12	22	28	3	9	12	6	4	6	139
36. Number of cases pending at end of year	9	7	11	18	16	18	5	20	11	10	6	10	2	8	151
	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.
37. Amount of fines...	1,669·50	1,822·50	1,984·00	2,390·50	1,081·00	1,591·00	3,055·00	2,164·00	2,173·50	1,754·00	2,052·50	2,707·00	1,211·00	1,834·00	27,489·50

(30) *Food Trades Inspections in 1922.*

Ward.	Bakeries.	Dairies.	Eating-houses.	Public Markets.
Fort ...	66 ...	— ...	726 ...	—
Pettah ...	75 ...	— ...	237 ...	61
San Sebastian ...	45 ...	— ...	277 ...	222
St. Paul's ...	108 ...	203 ...	304 ...	46
Kotahena North ...	61 ...	37 ...	127 ...	101
Kotahena South ...	101 ...	99 ...	91 ...	—
New Bazaar ...	68 ...	57 ...	147 ...	—
Maradana North ...	42 ...	67 ...	109 ...	—
Maradana South ...	68 ...	23 ...	169 ...	142
Maradana East ...	31 ...	23 ...	44 ...	20
Slave Island ...	75 ...	42 ...	91 ...	—
Kollupitiya ...	35 ...	132 ...	92 ...	39
Wellawatta North ...	53 ...	107 ...	30 ...	77
Wellawatta South ...	46 ...	79 ...	135 ...	—
Total ...	874	869	2,579	708

(30A) *Damaged Foodstuffs condemned, 1922.*

	Cwt. qr. lb.	
Beef	0 0 16	
Salt meat	0 0 5	
Mutton	0 0 12½	
Sweetmeats	0 0 ½	
Potatoes	1 1 10	and 665 bags
Flour	531 bags	
Sardines	653 tins	
Foodstuffs condemned at Customs.		
Rice	19 bags	
Potatoes	158 bags and 788 cwt.	
Dry fish	12 bundles	
Cocoa	639 tins	
Other tinned provisions	29 cases	
Foodstuffs condemned at Chalmers' Granaries.		
Rice	1,384½ bushels	
Foodstuffs condemned at Manning Market.		
Rice	156½ bushels	
Foodstuffs condemned at Baghdad Warehouse.		
Rice	35 bushels	

(31) *Prosecutions: Details.*

	No. of Prosecutions.	No. of Convictions.
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy premises ...	730 ...	685
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy tea boutique ...	3 ...	—
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy laundry ...	9 ...	9
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy dairy ...	18 ...	20
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy aerated water factory	3 ...	3
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy poultry mart ...	1 ...	1
Section 1, sub-section (1), of Ordinance No. 15 of 1862: Filthy cattle shed ...	1 ...	2
Section 1, sub-section (2), of Ordinance No. 15 of 1862: Foul privy ...	3 ...	3
Section 1, sub-section (4), of Ordinance No. 15 of 1862: Nuisance by cattle, swine, &c.	102 ...	115
Section 1, sub-section (9), of Ordinance No. 15 of 1862: Selling unwholesome food	3 ...	3
Section 39 of Ordinance No. 1 of 1896: Unlicensed dairy	8 ...	7
Section 43 of Ordinance No. 1 of 1896: Storing milk in living room ...	1 ...	1
Section 53 of Ordinance No. 1 of 1896: Unlicensed laundry	40 ...	39
Section 26 of part 1 of Ordinance No. 3 of 1897: (Plague Regulations) Failure to report infectious disease	1 ...	1
Section 41A of Ordinance No. 3 of 1897: (Plague Regulations) Removing small-pox patient	1 ...	1
Section 43, part 1 of Ordinance No. 3 of 1897: (Plague Regulations) Going about in public with smallpox	1 ...	1
Section 38, part 1 of Ordinance No. 3 of 1897: Failure to fill up well ...	1 ...	2
Regulation 1 made under Ordinance No. 3 of 1897: Storing rice in place not approved by Chairman	19 ...	18
Sections 109(1) and 110(5) of Ordinance No. 6 of 1910: Using polluted water in vegetable garden	1 ...	1
Section 110 of Ordinance No. 6 of 1910: Spitting in public market ...	12 ...	12
Section 178 of Ordinance No. 6 of 1910: Failure to limewash	67 ...	54
Section 190 of Ordinance No. 6 of 1910: Failure to close abandoned quarry ...	1 ...	1
Section 190B of Ordinance No. 6 of 1910: Failure to close cesspit ...	50 ...	25
Carried forward ...	1,076	1,004

(31) *Prosecutions: Details*—contd.

	No. of Prosecutions.	No. of Convictions.
Brought forward ...	1,076	1,004
Section 194 of Ordinance No. 6 of 1910: Committing nuisance	5	2
Section 205 of Ordinance No. 6 of 1910: Failure to report infectious disease ...	19	16
Section 212 of Ordinance No. 6 of 1910: Unlicensed offensive trades ...	2	2
Rule 29 of chapter VIII., by-laws: Digging pits without permission ...	5	4
Rule 4 of chapter IX., by-laws: Filthy bathing well	1	—
Rule 1 of chapter XI., by-laws: Unlicensed bakery	3	2
Rule 4 of chapter XI., by-laws: Filthy bathing tubs	3	2
Rule 3 of chapter XI., by-laws: Neglect to effect improvement to eating-house ...	3	3
Rule 7 of chapter XI., by-laws: Filthy bakery	26	23
Rule 7 of chapter XI., by-laws: Filthy eating-house	97	106
Rule 8 of chapter XI., by-laws: Unclean workmen in bakery	11	11
Rule 11 of chapter XI., by-laws: Unlicensed eating-house	32	29
Rule 3 of chapter XIII., by-laws: Misbehaving or committing nuisance in public market	32	40
Rule 9 of chapter XIII., by-laws: Unlicensed fish vendor	3	3
Rule 11 of chapter XIII., by-laws: Filthy private stall	85	84
Rule 20 of chapter XIII., by-laws: Unregistered servant in stall	1	1
Rule 28 of chapter XIII., by-laws: Throwing rubbish in market	9	8
Rule 29 of chapter XIII., by-laws: Filthy public stall	27	25
Rule 31 of chapter XIII., by-laws: Neglect to serve public in stall ...	12	12
Rule 33 of chapter XIII., by-laws: Extending stall in market	1	1
Rule 34 of chapter XIII., by-laws: Obstruction of passage in public market ...	145	139
Rule 2 of chapter XIV., by-laws: Exposing food to dust and flies	308	275
Rule 3 of chapter XIV., by-laws: Sale of adulterated milk	132	120
Rule 5 of chapter XIV., by-laws: Refusing sample of milk	5	5
Rule 7 of chapter XIV., by-laws: Unlicensed milk vendor	167	154
Section 180 of Penal Code: Giving false information to public officer ...	1	1
By-law in *Gazette* 6,907 of November, 1917: Failure to screen lavatory ...	1	1
Total ...	2,212	2,073

(32) *Convictions and Fines.*

Year.	Convictions.	Total Fines. Rs. c.	Average Fines. Rs. c.
1914 ...	1,878 ...	25,551 35 ...	13 60
1915 ...	1,774 ...	24,014 50 ...	13 53
1916 ...	2,246 ...	31,157 0 ...	13 87
1917 ...	1,777 ...	22,307 50 ...	12 55
1918 ...	*1,349 ...	12,819 0 ...	9 50
1919 ...	1,745 ...	15,498 70 ...	8 88
1920 ...	1,986 ...	15,035 75 ...	7 57
1921 ...	2,517 ...	14,978 25 ...	5 95
1922 ...	1,959 ...	27,489 50 ...	14 3

* Influenza year.

SANITATION BRANCH (SUB-BRANCHES) METHOD OF WORK.

(1) *Mosquito Prevention Sub-Branch.*—Routine work in connection with the prevention of mosquito nuisance is confined to the five blocks of the town previously mentioned, and consists of systematic house to house visitation, and search for and abolition of mosquito breeding places within these blocks. It also includes collection of mosquitoes and their larvas for identification. One overseer and two coolies are detailed for work in each block, while one overseer and two coolies are specially detailed to carry out investigations in connection with complaints of mosquito nuisance all over the town. Every case of Malaria believed or suspected to have been acquired within the town, is at once investigated by the mosquito staff. Details of this work done during 1922 are given in statement 33.

(33) *Anti-Mosquito Work.*

(1) Complaints from Householders.

Number of complaints received	129
Number of premises visited	856
Number of potential breeding places found ...	26,292
Number of actual breeding places found	1,514

(2) General Inspection Work.

Number of premises inspected	1,593
Number of tenements inspected	625
Number of potential breeding places found ...	31,198
Number of actual breeding places found	2,210

(3) Summary.

Number of complaints received	129
Number of premises inspected	2,449
Number of tenements inspected	625
Number of potential breeding places found ...	57,490
Number of actual breeding places found	3,724

(2) *Disinfection Sub-Branch Work.*—This work includes disinfection of infected articles by means of the Equifex steam disinfector at Suduwella, and disinfection of houses, latrines, &c. The steam disinfector is under the charge of an overseer, while the house disinfection is carried out by the staff of thirteen coolies under the supervision of the Sanitary Inspectors and Sub-Inspectors in whose wards or districts the work lies. The headquarters of the disinfection staff are at Dean's road market, where the coolies await orders which are given through the market keeper, who is provided with a telephone for this purpose. The market keeper keeps a record of all messages received, and instructions issued. A much better arrangement would be the one proposed, viz., to have a central disinfection station near the steam disinfector, and place the coolies under the overseer who is in charge of the steam disinfector.

Details of the work done by this Sub-Branch in 1922 are given in statements 29 and 34.

34.—WORK DONE AT THE STEAM DISINFECTING STATION, 1922.

Month.	No. of Pieces disinfected.	No. of Loads.
January	626 ...	18
February	169 ...	7
March	182 ...	6
April	203 ...	7
May	332 ...	8
June	256 ...	7
July	184 ...	13
August	705 ...	9
September	581 ...	14
October	600 ...	15
November	350 ...	6
December	911 ...	18
Total ...	5,099	128

35.—REGISTERED TRADES, 1922.

	No. on Register at end of previous Year.	No. discontinued during the Year under review.	New Registrations during the Year.	Total on Register at end of Year.
Dairies ...	40 ...	7 ...	13 ...	46
Bakeries ...	46 ...	6 ...	8 ...	48
Laundries ...	291 ...	91 ...	49 ...	249
Eating-houses ...	456 ...	78 ...	135 ...	513
Aerated water factories ...	13 ...	1 ...	1 ...	13
Opium divans ..	— ...	— ...	— ...	—

(3) *Cleansing Sub-Branch Work.*—This work consists of scavenging dangerously filthy private premises, especially premises where cases of enteric fever have occurred. The cleansing staff works under the supervision and control of the Sanitary Inspectors and Sub-Inspectors within their respective Wards and Divisions. Any Sanitary Inspector or Sub-Inspector is at liberty to requisition, when necessary, the services of the cleansing gang. Details of the work done by this Sub-Branch in 1922 are given in statement 29.

(4) *Plague Sub-Branch Work.*—The method of work of this Sub-Branch may be briefly described as follows :—

Plague cases and contacts are dealt with by the Public Health Department as regards isolation and removal to hospital on the lines recommended by the Special Committee on Plague as contained in the minutes dated February 28, 1921, adopted by Council on March 4, 1921. Trapping and poisoning of rats are carried out by the Rat Destruction staff of the Veterinary Department. Infected localities are dealt with by the special plague staff of the Public Health Department as follows :—

Upon the occurrence of a case of plague the locality is mapped out into two areas known as the inner and the outer circles. The inner circle includes the infected house and one or more adjacent houses according to their proximity to the infected house. The outer circle includes as wide an area as possible around the inner circle, the size of the outer circle being dependent upon the number and disposition of the houses, and the number of staff and appliances available at the time. Work commences simultaneously on the inner and outer circles; before anything else is done the floors of the houses in the inner circle are pesterined, so as to kill any infected fleas that might be about and would be a source of danger to the staff; the barefooted coolies of which are further protected by having their feet and legs painted with mustard oil, which has a repellant action upon fleas. All the contents of the houses in both the inner and outer circles are next taken out into the sun and dusted or washed by the householders themselves, assisted, if necessary, by the plague staff. The tiles of the roofs are removed in strips to let the sun in and to facilitate the search for rats, rat nests, and rat holes. All rat holes are fumigated and then opened up, if possible, in order to recover dead bodies of rats for enumeration and bacteriological examination. All rats killed or found dead within an infected area are sent to the Bacteriological Laboratory for examination. All rubbish and unserviceable articles are collected and sent to the refuse destructor. When the outer circle gangs close in upon the inner circle, they go over it carefully again so as to ensure destruction of all rats and rat fleas. When all the above work has been completed, the house is considered to be as safe as it is possible to make it, without complete demolition and reconstruction.

Details of the work done by the plague staff have already been given in section 12, statements 23 to 27.

20.—Markets Branch—Method of Work, &c.

There are eight Municipal markets distributed as follows :—

North Division.—(1) Grandpass, (2) Gintupitiya, (3) St. John's, (4) Gasworks street, (5) Kachcheri road.

South Division.—(6) Bambalapitiya, (7) Colpetty, (8) Dean's road.

The Municipal markets are under the general supervision, especially as regards sanitation and maintenance of order, of the Sanitary Inspector of the Ward in which each market is situated. Each market is in direct charge of a market keeper, who is an officer of the Public Health Department. Collection of revenue is carried out by the staff of the Revenue Department, assisted when necessary by the market keeper.

The principal duty of a market keeper is to see that the stallholders and the market coolies keep the market clean, an almost impossible task in the old fashioned markets with their primitive arrangements and shoddy construction, the adoption of which the lack of funds in the past, necessitated. The market keeper is also responsible for the maintenance of order within the market, and for enforcing the by-laws, regulations, and departmental orders relating to markets and the sale of food unfit for consumption.

The new markets now under construction at Borella and Kotahena are a great advance upon anything hitherto erected in Colombo or elsewhere in the Island, and the care and thought which has been given to their design, and the money which has been expended upon their construction and fittings will, it is believed, be fully justified by the greatly improved sanitary conditions under which the food supplies of the people will be dealt with in future in these public markets.

Market Branch—Staff and Equipment.

(1) *Grandpass Market.*

Nature of goods sold.—Fruit and vegetables.

Staff.—One market keeper ; two coolies.

This is a very primitive and unsatisfactory market, in which a considerable trade is carried on. Its trade is materially curtailed by the existence of a still more insanitary private market immediately adjacent.

(2) *Gintupitiya Market.*

Nature of goods sold.—Mutton.

Staff.—One cooly in charge. This is a very small market established for the convenience of a section of the community.

(3) *St. John's Market.*

Nature of goods sold.—Fish.

Staff.—One keeper, one assistant keeper, five coolies. This is the largest and busiest fish market in the town. It is not up-to-date in the matter of construction.

(4) *Gasworks Street.*—' Edinburgh Market. '

Nature of goods sold.—Beef, mutton, pork, fruit, vegetables, mats, and pillows.

Staff (shared by Kachcheri road market).—The beef, mutton, and pork stalls are out of date, and very insanitary.

(5) *Kachcheri Road Market.*

Nature of goods sold.—Fruit and vegetables.

Staff (shared by Edinburgh market).—One keeper, one assistant keeper, twelve coolies. This is the largest, best designed, and busiest fruit and vegetable market at present in the town. The accommodation is insufficient and the passages are too narrow ; the means adopted for protection from heat are unsatisfactory.

(6) *and* (7) *Bambalapitiya and Colpetty Markets.*

Nature of goods.—Beef, mutton, fish, fruit, and vegetables.

Staff (common to both markets).—One keeper, two coolies. These are small markets doing a comparatively small trade. They are old, out of date in construction, and badly situated.

(8) *Dean's Road Market.*

Nature of goods.—Beef, mutton, fish, fruit, vegetables.

Staff.—One keeper, one assistant keeper, six coolies. This market contains a range of up-to-date white tiled beef stalls, and a fine modern fish market ; but the other parts of the market are old and insanitary as regards construction. The rebuilding of this market was stopped years ago owing to lack of funds.

Equipment.—Hoses, buckets, brooms, &c.

21.—Laundries Branch.

This includes the two up-to-date Municipal laundries at Wekande and Blomendahl respectively. Each laundry is under the general supervision of the Sanitary Inspectors of the Wards in which they are situated, and is in direct charge of a resident caretaker, who has a cooly allowed him to do the sweeping and cleaning of the premises. The work of the caretaker includes maintaining order, keeping a watch on the Council's property, keeping the premises clean, and enforcing compliance by the dhobies with the laundry regulations, *e.g.*, keeping the clean and soiled linen in the rooms provided for the purpose, keeping rooms and tanks clean, preventing waste of water, checking attempts by the dhobies to introduce tables and other unauthorized furniture into the laundry, keeping out stray cattle, &c.

Equipment.—Shears, watering cans, dust bins, brooms, buckets.

22.—Dispensary Branch—Method of Work and Equipment.

Particulars in regard to situation, area served, and staff have already been given.

Work of Dispensaries.—Briefly the work of the dispensaries is to afford medical relief to the poor, and to serve as centres for the carrying on of maternity and child welfare work. The Medical Officer of each dispensary is in charge, and supervises and controls the work of the staff under him. The Health Visitors visit the homes of the working classes within their divisions, and advise mothers in regard to the care and feeding of their infants. They also check and supervise the work of the Municipal Midwives within their divisions. The midwives attend the confinements of the poorest classes, free of charge.

Details of the work done by the dispensary staff during 1922 are given in statements 36 to 39.

Equipment.—Each dispensary is equipped with dispensary appliances, an oil immersion microscope, midwifery forceps, and other necessary instruments and drugs.

(36) (*a*) *Statement of Work done at the Slave Island Dispensary, 1922.*

Number of patients treated	13,845
Number of visits by patients	28,266
Daily average attendance	91
Number of outdoor visits paid by the Medical Officer... ...	63
Number of Municipal employees treated	14
Number of confinement cases visited by the Medical Officer ...	42

Health Visitors.

Number of visits paid to houses	21,921
Number of houses where instructions *re* infant feeding given ...	3,356
Number of visits to hand-fed children	605
Number of labour cases visited	115
Number of dispensary tickets issued	4

(*b*) *Statement of Work done at St. Paul's Dispensary, 1922.*

Number of patients treated	19,713
Number of visits by patients	19,713
Daily average attendance	64
Number of outdoor visits paid by the Medical Officer... ...	104
Number of Municipal employees treated	25
Number of confinement cases visited by the Medical Officer ...	32

Health Visitors.

Number of visits paid to houses	31,602
Number of houses where instructions *re* infant feeding given ...	2,821
Number of visits to hand-fed children	932
Number of labour cases visited	152
Number of dispensary tickets issued	4

(*c*) *Statement of Work done at the Maradana Dispensary, 1922.*

Number of patients treated	12,059
Number of visits by patients	22,003
Daily average attendance	71
Number of outdoor visits paid by the Medical Officer... ...	89
Number of Municipal employees treated	20
Number of confinement cases visited by the Medical Officer ...	11

Health Visitors.

Number of visits paid to houses	27,789
Number of houses where instructions *re* infant feeding given ...	2,680
Number of visits to hand-fed children	584
Number of labour cases visited	10
Number of dispensary tickets issued	66

(*d*) *Statement of Work done at the Modera Dispensary, 1922.*

Number of patients treated	7,813
Number of visits by patients	12,384
Daily average attendance	60
Number of outdoor visits paid by the Medical Officer... ...	71
Number of Municipal employees treated...	54
Number of confinement cases visited by the Medical Officer ...	13

Health Visitors.

Number of visits paid to houses	18,491
Number of houses where instructions *re* infant feeding given ...	2,493
Number of visits to hand-fed children	287
Number of labour cases visited	26
Number of dispensary tickets issued	22

37.—Infant Feeding.

Year.	Visits at which Instructions re Infant Feeding were given to Mothers.	Visits to Hand-fed Children.	Remarks.
1910	590	(No record)	
1911	1,784	(No record)	
1912	1,858	609	Slave Island only.
1913	2,601	675	
1914	1,661	619	
1915	777	365	
1916	3,283	865	Slave Island and St. Paul's.
1917	3,507	1,775	
1918	3,150	589	
1919	4,552	2,630	
1920	6,786	1,920	Slave Island, St. Paul's, and Maradana.
1921	12,447	2,971	
1922	11,350	2,408	Slave Island, St. Paul's, Maradana, and Modera.

38.—Work of Municipal Midwives.

Year.	Number of Confinements attended.	Number of Children Born.	Total Births in Colombo.
1906	396	405	4,726
1907	476	479	4,280
1908	543	546	4,609
1909	567	571	4,589
1910	631	646	4,819
1911	615	623	5,280
1912	677	690	5,195
1913	661	668	5,693
1914	686	703	5,359
1915	638	653	5,641
1916	666	674	5,552
1917	662	671	5,860
1918	651	656	5,920
1919	560	562	5,907
1920	772	779	7,197
1921	743	749	8,724
1922	581	587	6,881

39.—Work done by Municipal Midwives, 1922.

Number of confinements attended	581
Number of children born	587
Number of stillbirths	29
Number of deaths within two weeks	13
Death-rate, exclusive of stillbirths	2·21 per cent.

23.—Cemeteries Branch. (Three Cemeteries.)

The general cemeteries and their staffs are as follows :—

(1) *Kanatta Cemetery.*

Staff.—One keeper, one assistant keeper, one head gardener, one messenger, seventeen coolies, and grave diggers.

(2) *Madampitiya Cemetery.*

Staff.—One keeper, six coolies, and grave diggers.

(3) *Liveramentu Cemetery.*

Staff.—One keeper, four coolies, and grave diggers.

The work of the cemetery staff includes the digging and tending of graves and general upkeep of the cemetery. The keeper is responsible for keeping the registers of burials and the cemetery plan up to date, furnishing burial returns, and collecting dues. He is also responsible for securing due observance of the Ordinance, by-laws, and regulations in regard to cemeteries and the burial and cremation of the dead.

24.—Enteric Hospital and Segregation Camp Branch.

These two adjacent institutions are conducted as one Branch.

Staff.—One part-time Medical Officer, 1 Apothecary, 1 Matron, 1 orderly, 2 male and 2 female hospital attendants, 1 ayah, 1 cook, 1 dhoby, 2 hospital coolies. The staff of the camp consists of 2 male and 1 female attendants and 1 cooly, and are under the control of the Medical Officer, the Apothecary being in charge.

Accommodation and Equipment.

Enteric Hospital.—Four wards each with twelve beds. Total accommodation forty-eight beds. These wards are cadjan roofed, half walled, and cement floored, and have all the necessary equipment for the treatment of enteric cases, including beds, tables, lamps, almirahs, linen, screens, baths, &c.

There is a small but fairly well equipped dispensary, quarters for the matron, a kitchen, dhoby tank, latrines, mortuary. There are no quarters for either the Apothecary or the servants. The Apothecary is paid a temporary house allowance of Rs. 40 per month, and the servants sleep in one of the unoccupied wards. This is an unsatisfactory so-called temporary arrangement which has been going on for years pending the erection of a new infectious diseases hospital by Government. The Medical Officer is a Government servant and is in charge of the adjacent infectious diseases hospital. The Council pays him a honorarium of Rs. 1,200 per annum. He exercises control over both hospital and camp. The Apothecary is in direct charge of the camp in addition to his dispensing duties.

The following is the record of work at the hospital during 1922 :—

(40) *Work done at the Municipal Enteric Hospital.*

Number of patients remaining from previous year	3
Number of admissions during the year	63
Number of deaths	12
Number discharged cured	49
Case mortality per cent.	18·18

The Segregation Camp consists of four blocks of earthern-floored cadjan huts, containing fifty-one rooms in all, one of which is used as an office, one as a disinfection chamber, and two as quarters for attendants. The camp is capable of accommodating about 150 contacts. There is ample kitchen, bath, and latrine accommodation. Town water is laid on. There is a small store for equipment, and a small boutique for sale of foodstuffs, &c., to contacts. The camp is beautifully situated on fairly high ground, surrounded by the Victoria Golf Links. The temporary fence enclosing the camp has practically vanished. No police guards are employed at the camp, and no trouble has hitherto been experienced. The contacts almost invariably express satisfaction with the conditions there, and their treatment. The boutique is let, free of rent, to a trader, who keeps a stock of provisions for sale to contacts at prices fixed by the Medical Officer of Health. Each adult contact is paid a sustenance allowance of cents 75 per day, and cents 37 per day per child under twelve years of age.

The following is the number of contacts segregated in the camp during 1922 :—

(41) *Segregation Camp.*

Disease.	Contacts from the Town.	Contacts from outside the Town.	Total.
Plague ...	494	58 ...	552
Smallpox ...	171	8 ...	179
Total ...	665	66	731

The sustenance allowance paid to contacts from outside the town is recovered from the Government Agent, Western Province.

Equipment.—Sleeping mats and pillows, long cloths, kitchen utensils, lanterns, dust bins, &c.

25.—Slaughter-house Branch.

Staff.—One Superintendent, one Assistant Superintendent and clerk, eleven coolies.

Work.—Animals are admitted from 6 A.M., to 10 A.M. and from 1 P.M. to 3 P.M. Slaughter takes place between 6 A.M. and 8 A.M. and between 1 P.M. and 3 P.M. or on production of a shipping order at any hour between 6 A.M. and 6 P.M. Work goes on every day, including Sundays and holidays. Every animal is subjected to a veterinary examination by the Superintendent prior to admission, and all meat is examined after slaughter before it's removal is allowed. In order to prevent slaughter of stolen animals, all Ceylon cattle are exposed on arrival in a shed situated outside the slaughter-house, near the road; each animal must be accompanied by a voucher signed by the Government Agent of the Province from which the animal is derived. Each voucher contains a description of the animal, including brandmarks, &c. After the animal has been identified with its description in the voucher and passed as fit for slaughter, it is admitted into the slaughter-house premises where it undergoes further exposure in a shed for twenty-four hours, after which its slaughter is allowed. Prior to slaughter both the seller and the butcher sign a slaughter permit form, on which a full description of the animal is recorded. The permit is countersigned by the Superintendent, the foils are sent to the Financial Assistant to the Chairman, and the counterfoils are filed at the slaughter-house. The cattle vouchers are then cancelled and returned to the several Government Agents who issued them.

Badly injured animals are slaughtered at once without previous exposure. Animals from the Quarantine Station and Cattle Mart are admitted direct into the slaughter-house.

Sheep, goats, and pigs are slaughtered immediately on admission.

All fees, which are fixed by by-law, are recovered at the time of admission, and are deposited with the shroff daily, the supporting documents being forwarded to the Financial Assistant.

If an animal is found to be suffering from an infectious disease, the Veterinary Department is informed and the animal is at once removed to the animal segregation camp.

Stolen animals are handed over to the police.

Animals which are in an emaciated condition, as the result of either disease or old age, are not allowed to be slaughtered. All carcases condemned after slaughter as unfit for human consumption, are sent to the destructor. Diseased parts, such as livers, &c., are buried on the premises after being rendered unfit to eat by treatment with carbolic acid.

The slaughter-house has accommodation for stalling 250 cattle, including buffaloes, in 3 sheds, 2 sheds for cattle and 1 for buffaloes. There is one stye for 25 pigs. There is no accommodation for penning sheep and goats, which remain in the carts in which they are brought until they are slaughtered.

There are 2 slaughter sheds in which 64 cattle can be simultaneously slaughtered and dressed, 1 pig slaughter shed for about 12 pigs; and one shed in which 176 sheep and goats can be simultaneously slaughtered. The slaughter sheds are on the open hall system, there being no provision for the screening of animals undergoing slaughter.

On an average about 67 cattle, 162 sheep and goats, and 8 pigs are slaughtered per day. About 1 in 6 of the cattle are poleaxed, the rest are slaughtered by cutting the throat—a barbarous and revolting method.

All carcases are stamped with the date on each of the four quarters before removal from the slaughter-house. Each carcase is accompanied by a pass signed by the Superintendent.

Equipment.—Resters, chain blocks, chains, poleaxes, hydrants, hoses, buckets, brooms, wheelbarrows, dust bins, garden tools, &c.

Details of work done in 1922 are given in statement 42.

(42) *Slaughter-house Return, 1922.*

Number of cattle slaughtered	24,519
Number of sheep and goats slaughtered	58,547
Number of pigs slaughtered	2,622
Number of cattle rejected before slaughter... ...	695
Number of cattle rejected owing to poor condition ...	680
Number of sheep and goats rejected	3
Number of cattle rejected after slaughter	39
Number of sheep and goats rejected after slaughter ...	—
Number of pigs rejected after slaughter	—

26.—Bacteriological Laboratory.

This branch of work has been fully dealt with by the Municipal Bacteriologist, Dr. Hirst, in his report, which is annexed.

The report of the City Analyst is annexed.

Public Health Department,
Colombo, April 6, 1923.

W. MARSHALL PHILIP,
Medical Officer of Health.

Annexure A.

(43) *Births and Deaths, with the Infant Mortality, for each Ward of the Town of Colombo during the Year 1922.*

Ward.	Births.										Deaths.										Infant deaths.
	Total Births.			Nationality.							Total Deaths.			Nationality.							
	Persons.	Males.	Females.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.	Persons.	Males.	Females.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.	
Colombo Town ...	6,881	3,618	3,263	86	512	4,120	899	922	239	103	7,710	4,267	3,443	34	318	4,124	1,533	1,196	229	276	1,702
Fort and Galle Face ...	3	3	—	1	—	—	—	1	—	1	20	18	2	4	—	4	6	5	1	—	1
Pettah	17	13	4	—	—	11	2	1	1	2	63	54	9	—	—	13	19	24	—	7	5
San Sebastian ...	210	115	95	1	4	65	17	113	5	5	291	149	142	—	4	85	47	138	4	13	85
St. Paul's	394	200	194	—	10	88	173	106	3	14	585	319	266	—	5	103	281	169	4	23	173
Kotahena	1,071	552	519	—	78	725	158	81	13	16	1,098	523	575	2	52	702	214	102	5	21	298
New Bazaar	484	273	211	1	47	202	46	168	11	9	622	317	305	—	30	221	66	267	17	21	205
Maradana	1,237	655	582	6	110	655	128	255	71	12	1,076	589	487	3	61	551	143	220	69	29	342
Slave Island	462	229	233	6	31	164	58	82	100	21	524	279	245	1	17	159	111	103	101	32	120
Kollupitiya	368	191	177	40	35	184	56	32	13	8	352	174	178	1	19	203	89	29	7	4	65
Wellawatta	621	329	292	14	73	399	69	43	12	11	346	172	174	3	31	217	56	26	6	7	101
Hospitals, town residents	2,014	1,058	956	17	124	1,627	192	40	10	4	1,357	833	524	9	79	725	359	86	10	89	307
Hospitals, untraced											293	187	106	—	9	201	60	12	4	7	
Hospitals, non-residents											1,083	653	430	11	11	940	82	15	1	23	

(44) *Deaths of Males and Females at different Age Periods for each Race in the Colombo Municipality during the Year 1922.*

Age at Death.	Europeans.		Burghers.		Sinhalese.		Tamils.		Moors.		Malays.		Others.		All Races.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Under 1 year of age (see particulars of statement)	1	—	33	32	512	412	164	142	170	136	28	28	21	23	929	773
Under Five Years :—																
1 year and under 2	—	1	14	12	154	142	29	44	51	44	9	18	4	5	261	266
2 years and under 3	1	—	2	2	90	90	32	23	35	35	5	4	3	4	168	158
3 years and under 4	1	—	2	4	51	50	19	19	13	12	5	1	1	1	92	87
4 years and under 5	—	—	1	3	23	29	9	10	4	8	6	4	—	3	43	57
Over Five Years :—																
5 years and under 10	—	—	9	4	65	71	19	21	14	17	3	2	1	1	111	116
10 years and under 15	1	—	5	2	48	42	23	13	16	8	2	3	3	—	98	68
15 years and under 20	1	2	3	5	92	79	47	26	40	26	2	5	18	3	203	146
20 years and under 25	1	—	10	11	101	126	88	46	31	31	3	9	32	1	266	224
25 years and under 35	7	—	9	16	236	269	131	89	61	63	8	6	51	9	503	452
35 years and under 45	7	1	14	16	203	143	119	59	55	30	7	7	32	2	437	258
45 years and under 55	3	2	13	11	190	136	74	44	36	17	7	3	22	3	345	218
55 years and under 65	2	1	17	16	159	96	62	31	39	14	7	4	8	2	294	164
65 years and under 75	1	1	18	7	146	87	29	34	28	20	6	3	5	2	233	154
75 years and under 85	—	—	8	15	93	87	29	26	43	28	10	8	3	3	186	167
85 years and over	—	—	1	3	43	59	11	21	28	43	8	6	7	3	98	135
Total ...	26	8	159	159	2206	1918	885	648	664	532	116	113	211	65	4267	3443
Persons ...	34		318		4,124		1,533		1,196		229		276		7,710	

(46) *Infant Mortality. Deaths at different Age Periods and from Several Causes.*

Cause of Death.	Age.												Race.							
	Age in Weeks.					Age in Months.														
	1	2	3	4	Total.	2	3	4	5	6	7–9	10–12	Total.	Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.	All Races.
I.—Development Diseases :—																					
1. Premature birth ...	123	4	3	6	136	1	—	—	—	—	—	—	1	—	7	99	16	9	3	3	137
2. Atalectasis ...	4	1	—	—	5	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	5
3. Atrophy and debility...	162	27	31	25	245	58	39	19	16	13	31	17	193	—	11	204	88	96	23	16	438
4. Others ...	5	2	1	—	8	1	2	2	—	1	7	2	15	—	2	14	—	6	1	—	23
II.—Diseases of Respiratory System :—																					
1. Laryngitis ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Croup ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3. Bronchitis ...	—	1	—	3	4	3	5	6	5	3	18	6	46	—	1	23	13	12	1	—	50
4. Pneumonia ...	1	2	—	3	6	12	17	13	25	24	65	39	195	—	9	120	42	22	3	5	201
5. Others ...	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	1	—	—	—	—	1
III.—Diseases of Digestive System :—																					
1. Diarrhœal ...	1	2	3	5	11	17	25	19	14	21	30	18	144	—	12	99	15	20	5	4	155
2. Dentition ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3. Others ...	3	5	5	9	22	11	11	2	8	4	8	4	48	—	3	40	16	5	4	2	70
IV.—Diseases of Nervous System :—																					
1. Convulsions ...	92	33	23	18	166	63	50	28	20	15	39	30	245	—	12	185	76	116	12	10	411
2. Laryngismus stridulus.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3. Tetanus ...	6	8	1	—	15	—	—	—	1	—	—	1	2	—	2	7	6	—	—	2	17
4. Others ...	1	—	—	—	1	—	—	—	—	—	2	1	3	—	—	3	1	—	—	—	4
V.—Tuberculous Diseases :—																					
1. Tabes messenterica ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Tubercular meningitis.	2	—	—	—	2	—	—	—	2	—	1	—	3	—	—	3	2	—	—	—	5
3. Others ...	1	—	—	—	1	—	—	—	—	—	1	1	3	—	—	2	1	1	—	—	4
VI.—Accidents :—																					
1. Injury ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Umbilical hæmorrhage	2	—	—	—	2	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	2
3. Suffocation ...	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	1	—	—	—	—	1
4. Other violence ...	10	—	—	—	10	—	—	—	—	—	—	—	—	—	—	8	1	1	—	—	10
VII.—Infectious Diseases :—																					
1. Smallpox ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Chickenpox ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3. Measles ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4. Whooping cough ...	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—	2	2
5. Mumps ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6 Diphtheria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7. Cerebro-spinal fever ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8. Scarlet fever ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
VIII.—Syphilis ...	2	2	2	2	8	12	10	4	1	5	2	2	36	—	2	30	9	3	—	—	44
IX.—All other Causes ...	16	3	4	2	25	19	14	9	7	10	21	17	97	1	4	78	20	15	4	—	122
Total ...	431	90	73	73	667	197	173	103	100	97	227	138	1035	1	65	924	306	306	56	44	1702

(45) *Causes of Deaths registered in Colombo during the Year 1922.*

Causes of Deaths.	Colombo Town.	Nationality. Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
All Causes.	7,710	34	318	4,124	1,533	1,196	229	276
I.—General Diseases :—								
1.—Epidemic Diseases	889	7	38	422	210	145	18	49
2.—Septic Diseases	63	—	3	39	11	5	1	4
3.—Tuberculous Diseases	682	2	35	373	131	92	24	25
4.—Venereal Diseases	72	—	2	47	17	6	—	—
5.—Cancer or Malignant Diseases	96	2	10	57	17	6	2	2
6.—Other General Diseases	219	1	15	122	42	25	3	11
II.—Diseases of the Nervous System and Organs of Special Sense	781	2	35	392	138	169	22	23
III.—Diseases of the Circulatory System	213	4	15	108	38	34	5	9
IV.—Diseases of the Respiratory System	1,484	4	58	786	342	186	34	74
V.—Diseases of the Digestive System	1,080	6	35	641	206	144	33	15
VI.—Non-venereal Diseases of the Genito-Urinary and Annexa	280	1	8	152	52	40	11	16
VII.—The Puerperal State	139	—	8	67	23	37	4	—
VIII.—Diseases of the Skin and of the Cellular Tissue	103	—	5	60	22	13	1	2
IX.—Diseases of the Bones and of the Organs of Locomotion	6	—	—	4	—	1	1	—
X.—Malformations	11	—	1	9	—	—	1	—
XI.—Diseases of Early Infancy	567	—	19	305	99	100	23	21
XII.—Old Age	481	—	13	231	91	110	27	6
XIII.—Affections produced by External Causes :—								
1.—Suicide	7	1	—	2	4	—	—	—
2.—Homicide	6	—	—	6	—	—	—	—
3.—Judicial Hanging or Execution	13	—	—	11	2	—	—	—
4.—Accident and other External Violence	108	3	4	64	17	11	—	9
XIV.—Ill-defined Diseases	410	1	14	223	71	72	19	10

I.—General Diseases.

Epidemic Diseases. 1.—Enteric Fever	179	5	13	122	22	10	1	6
2.—Typhus Fever	—	—	—	—	—	—	—	—
3.—Relapsing Fever	—	—	—	—	—	—	—	—
4.—(a) Malaria	99	1	3	46	23	19	4	3
4.—(b) Malarial Cachexia	28	—	2	8	7	4	4	3
5.—Smallpox (a) Vaccinated	—	—	—	—	—	—	—	—
5.—Smallpox (b) Not Vaccinated	—	—	—	—	—	—	—	—
5.—Smallpox (c) Doubtful	6	—	—	3	—	1	—	2
6.—Measles	1	—	—	—	—	1	—	—
7.—Scarlet Fever	—	—	—	—	—	—	—	—
8.—Whooping Cough	3	—	—	1	—	—	—	2
9.—(a) Diphtheria	7	1	—	4	1	1	—	—
9.—(b) Membranous Laryngitis	—	—	—	—	—	—	—	—
9.—(c) Croup	—	—	—	—	—	—	—	—
10.—Influenza	247	—	7	102	65	54	4	15
11.—Miliary Fever	—	—	—	—	—	—	—	—
12.—Asiatic Cholera	—	—	—	—	—	—	—	—
13.—Cholera Nostras	—	—	—	—	—	—	—	—
14.—(a) Amœbic Dysentery	2	—	—	1	1	—	—	—
14.—(b) Bacillary Dysentery	4	—	—	4	—	—	—	—
14.—(c) Dysentery (type not distinguished)	177	—	11	99	35	23	4	5
15.—Plague	128	—	1	29	54	31	—	13
16.—Yellow Fever	—	—	—	—	—	—	—	—
17.—Leprosy	1	—	—	—	1	—	—	—
18.—Erysipelas	6	—	1	2	1	1	1	—
19.—(a) Mumps	1	—	—	1	—	—	—	—
19.—(b) Varicella (Chickenpox)	—	—	—	—	—	—	—	—
19.—(c) Other Epidemic Diseases	—	—	—	—	—	—	—	—
Septic Diseases. 20.—(a) Pyæmia	2	—	—	2	—	—	—	—
20.—(b) Septicæmia	60	—	3	37	10	5	1	4
20.—(c) Vaccinia	1	—	—	—	1	—	—	—
21.—Glanders	—	—	—	—	—	—	—	—
22.—Anthrax	—	—	—	—	—	—	—	—
23.—Rabies, Hydrophobia	4	—	—	2	2	—	—	—
24.—Tetanus	71	—	1	37	18	7	—	8
25.—Mycoses	—	—	—	—	—	—	—	—
26.—Pellagra	—	—	—	—	—	—	—	—
27.—Beri-Beri	—	—	—	—	—	—	—	—
Tuberculosis Diseases. 28.—(a) Acute Pulmonary Tuberculosis	637	2	33	346	119	91	24	22
28.—(b) Chronic Pulmonary Tuberculosis	2	—	1	—	1	—	—	—
29.—Acute Miliary Tuberculosis	1	—	—	1	—	—	—	—
30.—Tuberculous Meningitis	5	—	—	—	4	—	—	1
31.—Abdominal Tuberculosis	5	—	—	4	—	—	—	1
32.—Tuberculosis of the Spine	1	—	—	—	1	—	—	—
33.—Tuberculosis of Joints	—	—	—	—	—	—	—	—
34.—Tuberculosis of other Organs (Lymphatism excepted)	24	—	1	18	4	—	—	1
35.—Disseminated Tuberculosis	7	—	—	4	2	1	—	—
36.—Rickets	53	—	3	36	6	8	—	—
37.—Syphilis	69	—	2	46	15	6	—	—
37a.—Parangi (Frambœsia Tropicum, Yaws)	1	—	—	1	—	—	—	—
38.—Gonococcus Infection	3	—	—	1	2	—	—	—

(45) *Causes of Deaths, &c.*—contd.

Causes of Deaths.	Colombo Town.	Nationality. Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
Cancer or Malignant Diseases.								
39.—Cancer and other malignant Tumours of the Buccal Cavity	29	—	—	19	7	1	—	2
40.—Cancer and other malignant Tumours of the Stomach, Liver	12	1	2	5	2	2	—	—
41.—Cancer and other malignant Tumours of the Peritoneum, Intestines, Rectum	4	—	—	2	—	1	1	—
42.—Cancer and other malignant Tumours of the Female Genital Organs	12	—	1	10	1	—	—	—
43.—Cancer and other malignant Tumours of the Breast	10	1	1	3	3	1	1	—
44.—Cancer and other malignant Tumours of the Skin	—	—	—	—	—	—	—	—
45.—Cancer and other malignant Tumours of other Organs or of Organs not specified	29	—	6	18	4	1	—	—
46.—Other Tumours (Tumours of the Female Genital Organs excepted)	16	—	2	10	1	2	—	1
47.—Acute Rheumatic Fever	1	—	—	—	—	—	1	—
48.—(*a*) Rheumatoid Arthritis	—	—	—	—	—	—	—	—
48.—(*b*) Osteo-Arthritis	—	—	—	—	—	—	—	—
48.—(*c*) Chronic Rheumatism	5	—	1	2	2	—	—	—
48.—(*d*) Gout	—	—	—	—	—	—	—	—
49.—Scurvy	1	—	—	1	—	—	—	—
50.—Diabetes (Mellitus)	44	—	7	24	6	5	1	1
51.—Exophthalmic Goitre	—	—	—	—	—	—	—	—
52.—Addison's Disease	—	—	—	—	—	—	—	—
53.—(*a*) Leucocythæmia	—	—	—	—	—	—	—	—
53.—(*b*) Lymphadenoma	1	—	—	1	—	—	—	—
54.—(*a*) Anæmia	17	1	1	7	3	3	1	1
54.—(*b*) Chlorosis	—	—	—	—	—	—	—	—
55.—(*a*) Diabetes Insipidus	—	—	—	—	—	—	—	—
55.—(*b*) Purpura	1	—	—	—	1	—	—	—
55.—(*c*) Hæmophildia	—	—	—	—	—	—	—	—
55.—(*d*) Other General Diseases	1	—	—	1	—	—	—	—
56.—Alcoholism (acute or chronic)	3	—	—	—	3	—	—	—
57.—Chronic Lead Poisoning	—	—	—	—	—	—	—	—
58.—Other Chronic Poisonings (occupational)	—	—	—	—	—	—	—	—
59.—Other Chronic Poisonings (non-occupational)	—	—	—	—	—	—	—	—
II.—Diseases of the Nervous System and of the Organs of Special Sense.								
60.—Encephalitis	5	—	—	5	—	—	—	—
61.—(*a*) Simple Meningitis	30	—	1	21	5	1	1	1
61.—(*b*) Cerebro-Spinal Fever	—	—	—	—	—	—	—	—
61.—(*c*) Septic Meningitis from various causes	3	—	1	2	—	—	—	—
62.—Locomotor Ataxia	—	—	—	—	—	—	—	—
63.—Other Diseases of the Spinal Cord	6	—	—	2	1	2	1	—
64.—Cerebral Hæmorrhage, Apoplexy	53	1	5	24	12	8	—	3
65.—Softening of the Brain	1	—	—	1	—	—	—	—
66.—Paralysis without specified cause	120	—	11	71	16	13	4	5
67.—General Paralysis of the Insane	1	—	—	1	—	—	—	—
68.—Other forms of mental alienation	1	—	1	—	—	—	—	—
69.—Epilepsy	13	—	—	6	4	2	—	1
70.—Convulsions (non-puerperal)	119	—	4	65	17	27	4	2
71.—Convulsions of Infants	411	—	12	185	76	116	12	10
72.—Chorea	—	—	—	—	—	—	—	—
73.—Neuralgia and Neuritis	4	—	—	1	3	—	—	—
74.—Other Diseases of the Nervous System	11	—	—	7	3	—	—	1
75.—Diseases of the Eyes and their Annexa...	1	—	—	1	—	—	—	—
76.—(*a*) Mastoid Disease	—	—	—	—	—	—	—	—
76.—(*b*) Other Diseases of the Ears	2	1	—	—	1	—	—	—
III.—Diseases of the Circulatory System.								
77.—Pericarditis	8	—	—	4	3	—	—	1
78.—(*a*) Simple Acute Endocarditis	5	—	—	4	—	1	—	—
78.—(*b*) Infective Endocarditis	—	—	—	—	—	—	—	—
79.—(*a*) Myocarditis	5	—	2	2	—	—	—	1
79.—(*b*) Valvular Disease	11	—	—	6	1	3	1	—
79.—(*c*) Other Organic Diseases of the Heart	98	2	5	52	17	20	1	1
80.—Angina Pectoris	5	—	1	1	1	2	—	—
81.—(*a*) Aneurism	9	2	1	2	3	—	—	1
81.—(*b*) Atheroma, Arteriosclerosis.	10	—	3	2	3	1	1	—
81.—(*c*) Other Diseases of the Arteries	1	—	—	1	—	—	—	—
82.—(*a*) Cerebral Embolism and Thrombosis	11	—	—	5	2	2	—	2
82.—(*b*) Embolism and Thrombosis other than Cerebral	8	—	—	5	2	—	—	1
83.—(*a*) Phlebitis	2	—	1	1	—	—	—	—
83.—(*b*) Varicose Veins	—	—	—	—	—	—	—	—
83.—(*c*) Hæmorrhoids	10	—	1	4	1	3	1	—
83.—(*d*) Other Diseases of the Veins	—	—	—	—	—	—	—	—
84.—(*a*) Lymphatism, Status Lymphaticus	1	—	—	1	—	—	—	—
84.—(*b*) Elephantiasis Arabum (Filariasis)	1	—	—	1	—	—	—	—
84.—(*c*) Other Diseases of the Lymphatic System	—	—	—	—	—	—	—	—

(45) *Causes of Deaths, &c.*—contd.

Causes of Deaths.	Colombo Town.	Nationality. Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
85.—(a) Hæmorrhage from any part	22	—	1	14	4	1	—	2
85.—(b) Other Diseases of the Circulatory System	6	—	—	3	1	1	1	—
IV.—Diseases of the Respiratory System.								
86.—Diseases of the Nose	—	—	—	—	—	—	—	—
87.—(a) Laryngismus Stridulus	—	—	—	—	—	—	—	—
87.—(b) All forms of Laryngitis (Diphtheritic excepted)	1	—	—	1	—	—	—	—
87.—(c) Other Diseases of the Larynx	2	—	—	2	—	—	—	—
88.—Diseases of the Thyroid Body	—	—	—	—	—	—	—	—
89.—Acute Bronchitis	132	—	5	59	35	25	4	4
90.—(a) Chronic Bronchitis	83	1	5	39	17	20	—	1
90.—(b) Bronchiectasis	2	—	—	2	—	—	—	—
91.—Broncho-Pneumonia	512	—	20	290	101	67	14	20
92.—Pneumonia	647	2	21	339	164	65	13	43
93.—(a) Empyema	13	1	2	8	1	—	—	1
93.—(b) Other Pleurisy	14	—	2	8	2	—	1	1
94.—Pulmonary Congestion, Pulmonary Apoplexy	35	—	2	16	10	3	1	3
95.—Gangrene of the Lungs	3	—	—	1	1	—	—	1
96.—Asthma	33	—	—	18	8	6	1	—
97.—Pulmonary Emphysema	—	—	—	—	—	—	—	—
98.—Other Diseases of the Respiratory System (Tuberculosis excepted)	7	—	1	3	3	—	—	—
V.—Diseases of the Digestive System.								
99.—(a) Diseases of the Teeth and Gums (Oral Sepsis)	—	—	—	—	—	—	—	—
99.—(b) Thrush, Stomatitis	16	—	—	9	3	3	1	—
99.—(c) Parotitis (Septic)	—	—	—	—	—	—	—	—
99.—(d) Other Diseases of the Mouth and Annexa	—	—	—	—	—	—	—	—
100.—(a) Tonsillitis (other than Diphtheritic)	3	—	—	1	—	2	—	—
100.—(b) Quinsy	—	—	—	—	—	—	—	—
100.—(c) Other Diseases of the Pharynx	2	—	—	1	—	1	—	—
101.—Diseases of the Œsophagus	—	—	—	—	—	—	—	—
102.—Gastric Ulcer	2	—	1	1	—	—	—	—
103.—(a) Gastritis, Gastric Catarrh	13	—	—	7	2	3	1	—
103.—(b) Other Diseases of the Stomach (Cancer excepted)	2	—	—	—	1	1	—	—
104. & 105.—(a) Epidemic Diarrhœa	2	—	—	2	—	—	—	—
104. & 105.—(b) Diarrhœa Infantile, Diarrhœa due to food	22	—	2	14	1	5	—	—
104. & 105.—(c) Diarrhœa undefined	179	—	4	87	59	26	3	—
104. & 105.—(d) Enteritis	275	—	14	170	38	42	8	3
104. & 105.—(e) Gastro-enteritis	61	—	4	35	8	9	3	2
104. & 105.—(f) Colic	—	—	—	—	—	—	—	—
104. & 105.—(g) Intestinal Ulceration, Colitis	29	2	2	19	3	1	1	1
104. & 105.—(h) Duodenal Ulcer	—	—	—	—	—	—	—	—
106.—Anchylostomiasis	135	—	—	80	35	13	3	4
107.—Intestinal Parasites	146	—	3	93	19	18	11	2
108.—Appendicitis and Typhlitis	3	—	—	2	1	—	—	—
109.—(a) Hernia	11	—	—	5	1	4	—	1
109.—(b) Intestinal Obstruction	11	—	—	8	1	1	1	—
110.—(a) Psilosis (Sprue or Ceylon Sore-mouth)	8	2	—	3	1	2	—	—
110.—(b) Other Diseases of the Intestine	18	1	1	10	3	2	—	1
111.—Acute Yellow Atrophy of the Liver	2	—	—	2	—	—	—	—
112.—Hydatid Tumour of the Liver	—	—	—	—	—	—	—	—
113.—(a) Cirrhosis of the Liver (Alcoholic)	—	—	—	—	—	—	—	—
113.—(b) Cirrhosis of the Liver (Toxic)	43	—	4	27	9	2	—	1
114.—Gallstones	—	—	—	—	—	—	—	—
115.—Other Diseases of the Liver	21	—	—	14	6	1	—	—
116.—Diseases of the Spleen	2	—	—	2	—	—	—	—
117.—Peritonitis (cause unknown)	61	1	—	40	12	7	1	—
118.—Other Diseases of the Digestive System (Cancer and Tuberculosis excepted)	13	—	—	9	3	1	—	—
VI.—Non-Venereal Diseases of the Genito-Urinary System and Annexa.								
119.—Acute Nephritis	186	1	5	94	37	29	10	10
120.—Bright's Disease	25	—	1	14	2	6	1	1
121.—Chyluria	—	—	—	—	—	—	—	—
122.—Other Diseases of the Kidneys and Annexa	47	—	1	33	9	2	—	2
123.—Urinary Calculi	—	—	—	—	—	—	—	—
124.—Diseases of the Bladder	8	—	—	3	3	1	—	1
125.—Diseases of the Urethra, Urinary Abscess, &c.	—	—	—	—	—	—	—	—
126.—Diseases of the Prostate	2	—	—	1	—	—	—	1
127.—Diseases of the Male Genital Organs (non-venereal)	3	—	—	1	—	2	—	—
128.—Uterine Hæmorrhage (non-puerperal)	1	—	—	—	—	—	—	1
129.—Uterine Tumour (non-cancerous)	1	—	—	1	—	—	—	—
130.—Other Diseases of the Uterus	3	—	1	2	—	—	—	—
131.—Cysts and other Tumours of the Ovary	1	—	—	1	—	—	—	—
132.—Salpingitis and other Diseases of the Female Genital Organs	3	—	—	2	1	—	—	—
133.—Non-puerperal Diseases of the Breast (Cancer excepted)	—	—	—	—	—	—	—	—

(45) *Causes of Deaths, &c.*—contd.

Causes of Deaths.	Colombo Town.	Nationality. Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
VII.—The Puerperal State.								
134.—(*a*) Abortion, Miscarriage	3	—	—	1	2	—	—	—
134.—(*b*) Ante-partum Hæmorrhage	3	—	1	1	—	1	—	—
134.—(*c*) Ectopic Gestation	3	—	—	3	—	—	—	—
134.—(*d*) Other Accidents of Pregnancy	13	—	1	7	2	2	1	—
135.—Puerperal Hæmorrhage	6	—	1	2	—	2	1	—
136.—Other Accidents of Childbirth	3	—	—	3	—	—	—	—
137.—Puerperal Septicæmia	63	—	4	28	10	19	2	—
138.—(*a*) Puerperal Albuminuria, Nephritis, &c.	—	—	—	—	—	—	—	—
138.—(*b*) Puerperal Eclampsia	11	—	—	6	4	1	—	—
139.—(*a*) Puerperal Phlegmasia, Alba Dolens	—	—	—	—	—	—	—	—
139.—(*b*) Puerperal Embolism, Sudden Death, &c.	—	—	—	—	—	—	—	—
140.—(*a*) Puerperal Insanity	1	—	—	—	—	1	—	—
140.—(*b*) Consequences of Childbirth (not otherwise defined)	32	—	1	16	5	10	—	—
141.—Puerperal Diseases of the Breast	1	—	—	—	—	1	—	—
VIII.—Diseases of the Skin and of the Cellular Tissue.								
142.—Gangrene	20	—	—	14	3	3	—	—
143.—(*a*) Carbuncle	6	—	1	2	3	—	—	—
143.—(*b*) Furuncle (Boil)	—	—	—	—	—	—	—	—
144.—(*a*) Phlegmon	2	—	—	1	1	—	—	—
144.—(*b*) Acute Abscess, Abscess unqualified	16	—	—	11	3	1	—	1
145.—(*a*) Ulcer, Bedsore	20	—	—	8	6	5	1	—
145.—(*b*) Eczema	1	—	1	—	—	—	—	—
145.—(*c*) Pemphigus	—	—	—	—	—	—	—	—
145.—(*d*) Other Diseases of the Integumentary System (Elephantiasis Arabum excepted)	38	—	3	24	6	4	—	1
IX.—Diseases of the Bones and of the Organs of Locomotion.								
146.—Diseases of the Bones (Tuberculosis and Mastoid Disease excepted)	1	—	—	—	—	1	—	—
147.—Diseases of the Joints (Tuberculosis and Rheumatism excepted)	4	—	—	3	—	—	1	—
148.—Amputations	—	—	—	—	—	—	—	—
149.—Other Diseases of the Organs of Locomotion.	1	—	—	1	—	—	—	—
X.—Malformations.								
150.—(*a*) Congenital Hydrocephalus	—	—	—	—	—	—	—	—
150.—(*b*) Congenital Diseases of the Heart	3	—	—	3	—	—	—	—
150.—(*c*) Other Congenital Malformation (Still-births excluded)	8	—	1	6	—	—	1	—
XI.—Diseases of Early Infancy.								
151.—(*a*) Premature Birth	137	—	7	99	16	9	3	3
151.—(*b*) Debility	356	—	9	162	70	82	17	16
151.—(*c*) Want of Breast Milk	47	—	2	27	10	4	2	2
151.—(*d*) Atrophy, Icterus, Sclerema Neonatorum	16	—	1	10	3	1	1	—
152.—(*a*) Atelectasis	5	—	—	5	—	—	—	—
152.—(*b*) Injuries at Birth	1	—	—	—	—	1	—	—
152.—(*c*) Other Diseases peculiar to early Infancy	4	—	—	2	—	2	—	—
153.—Lack of care	—	—	—	—	—	—	—	—
XII.—Old Age.								
154.—Senility	481	—	13	234	91	110	27	6
XIII.—Affections produced by External Causes.								
155.—Suicide by Poison	—	—	—	—	—	—	—	—
156.—Suicide by Asphyxia	—	—	—	—	—	—	—	—
157.—Suicide by Hanging or Strangulation	4	—	—	—	4	—	—	—
158.—Suicide by Drowning	—	—	—	—	—	—	—	—
159.—Suicide by Firearms	1	—	—	1	—	—	—	—
160.—Suicide by Cutting or Piercing Instruments.	1	1	—	—	—	—	—	—
161.—Suicide by Jumping from high places	—	—	—	—	—	—	—	—
162.—Suicide by Crushing	—	—	—	—	—	—	—	—
163.—Suicide by other means	1	—	—	1	—	—	—	—
164.—Poisoning by Food	1	—	—	1	—	—	—	—
165.—(*a*) Snake-bite	—	—	—	—	—	—	—	—
165.—(*b*) Insect Stings (Venomous)	—	—	—	—	—	—	—	—
165.—(*c*) Other Acute Poisonings	7	1	—	3	—	3	—	—
166.—Conflagration	—	—	—	—	—	—	—	—
167.—Burns (Conflagration excepted)	18	—	1	11	3	3	—	—
168.—Absorption of Deleterious Gases (Conflagration excepted)	—	—	—	—	—	—	—	—
169.—Accidental Drowning	13	—	2	4	4	2	—	1
170.—Traumatism by Firearms	1	—	—	—	1	—	—	—
171.—Traumatism by Cutting or Piercing Instruments	1	—	—	1	—	—	—	—

(45) *Causes of Deaths, &c.*—contd.

Causes of Deaths.	Colombo Town.	Nationality. Europeans.	Burghers.	Sinhalese.	Tamils.	Moors.	Malays.	Others.
172.—(*a*) Traumatism by Fall from trees	2	—	—	1	—	—	—	1
172.—(*b*) Traumatism by Fall from heights other than trees	2	—	—	1	1	—	—	—
172.—(*c*) Traumatism by other Accidental Fall.	6	—	—	2	2	—	—	2
173.—Traumatism in Mines and Quarries	—	—	—	—	—	—	—	—
174.—Traumatism by Machines	—	—	—	—	—	—	—	—
175.—Traumatism by Other Crushing (Vehicles, Railroad Landslides, &c.)	24	—	—	19	—	2	—	3
176.—Injuries by Animals	—	—	—	—	—	—	—	—
177.—Starvation	4	—	—	2	2	—	—	—
178.—Excessive Cold	—	—	—	—	—	—	—	—
179.—Effects of Heat	—	—	—	—	—	—	—	—
180.—Lightning	—	—	—	—	—	—	—	—
181.—Electricity (Lightning excepted)	—	—	—	—	—	—	—	—
182.—Homicide by Firearms	—	—	—	—	—	—	—	—
183.—Homicide by Cutting or Piercing Instruments	4	—	—	4	—	—	—	—
184.—Homicide by other means	2	—	—	2	—	—	—	—
185.—Fractures (cause not specified)	19	2	1	10	3	1	—	2
186.—(*a*) Judicial Hanging or Execution	13	—	—	11	2	—	—	—
186.—(*b*) Other External Violence	10	—	—	9	1	—	—	—
XIV.—Ill-defined Diseases.								
187.—(*a*) Dropsy	2	—	—	2	—	—	—	—
187.—(*b*) Ascites	2	—	—	1	—	1	—	—
187.—(*c*) Other Ill-defined Organic Diseases	1	—	—	1	—	—	—	—
188.—(*a*) Syncope	—	—	—	—	—	—	—	—
188.—(*b*) Sudden Death (not otherwise defined).	—	—	—	—	—	—	—	—
189.—(*a*) Heart-failure	25	—	2	14	4	4	—	1
189.—(*b*) Atrophy, Debility, &c. (one year and over)	134	1	4	78	27	18	1	5
189.—(*c*) Teething	—	—	—	—	—	—	—	—
189.—(*d*) Pyrexia	51	—	2	30	5	12	17	2
189.—(*e*) Marasmus and Asthenia	185	—	6	88	35	37	—	2
189.—(*f*) Other Ill-defined Causes	10	—	—	9	—	—	1	—
189.—(*g*) Diseases not specified	—	—	—	—	—	—	—	—

(47) *Changes in the Personnel of the Staff, 1922.*

Medical Officers.—Dr. V. K. Paramanayagam appointed Medical Officer, Modera Dispensary, on May 15, 1922.

Apothecaries.—Mr. T. W. Lappen appointed Apothecary, Modera Dispensary, on April 7, 1922.

Clerks.—Mr. Walter P. Jayawardena appointed Clerk on March 13, 1922, in place of Mr. P. B. Dabera, resigned.

Health Visitors.—Mrs. Maud John appointed Health Visitor, Modera Dispensary, on April 1, 1922; Miss I. De La Harpe appointed Health Visitor, Modera Dispensary, on April 1, 1922; Mrs. C. L. Schrader appointed Health Visitor, Slave Island Dispensary, on April 1, 1922; Miss L. G. Wilson appointed Health Visitor, Slave Island Dispensary, on August 1, 1922, in place of Mrs. C. L. Schrader, resigned.

Overseers.—Mr. R. W. Burke appointed Overseer, Plague Prevention, on February 11, 1922, in place of Mr. W. H. de Moor, resigned.

Orderlies.—H. David Caldera appointed Orderly, Modera Dispensary, on April 1, 1922.

Annexure B.

REPORT OF THE CITY ANALYST FOR 1922.

The Laboratory, Hyde Park Corner,
Colombo, January 9, 1923.

I HAVE the honour to send my annual report for the year ending December 31, 1922. Samples examined were as follows :—

	Number of Samples.
January.	
Milks	80
Town water	14
Bleaching powder	1
Burnt lime	1
February.	
Milks	74
Well water	3
Town water	13
Labugama water	2
March.	
Milks	101
Town water	15
Well water	1
Water from Queen's House ...	1
Ice	1
Soda water	1
Lemonade water	2
Coke	1
April.	
Milks	90
Town water	14
May.	
Milks	79
Town water	15
Well water	1
Soda water	2
June.	
Milks	83
Town water	23
Well water	1
July.	
Milks	87
Town water	13
Well water	3
August.	
Town water	15
Milks	92
September.	
Milks	83
Town water	14
Well water	5
October.	
Milks	79
Sewage	1
Town water	14
Well water	2
November.	
Milks	82
Well water	6
Town water	15
Sewage	2
Spirit	1
December.	
Milks	92
Town water	14
Well water	1
Total ...	1,240

Total number of milks	1,021
Total number of milks condemned	194
Total number of town waters	182
Total number of town waters condemned	—
Total number of well waters	23
Total number of well waters condemned	20
Total number of well waters suspicious	3
Total number of miscellaneous samples	23

1,240 samples were examined in all.

The number of milk samples condemned was 194 out of 1,022 or 18·98 per cent., compared with 24·5 per cent. in 1921.

The 182 samples of town water examined were all of good quality, though a slight deterioration shown by the presence of small quantities of free ammonia occurred in June during the filling of the reservoir after the prolonged drought.

Out of 23 well waters examined, 20 were condemned as unfit for human consumption and the remaining three were suspicious.

Two samples of dry and wet weather sewage were reported on in December. The total suspended matter was the same in both, but the total solids and solids in solution were lower in the wet weather effluent.

The miscellaneous samples included spirit, mineral waters, ice, lime, bleaching powder, and coke.

Mr. Bruce attended three meetings of the Calcium Carbide Committee.

M. KELWAY BAMBER,
City Analyst.

Annexure C.

REPORT OF THE MUNICIPAL BACTERIOLOGIST FOR 1922.

CONTENTS.

1.—LABORATORY.

The reconstruction and extension of the laboratory, sanctioned in 1921, was carried out this year under the supervision of Mr. C. H. Kilmister, Chief Assistant Works Engineer. The work being rapidly executed and full use made of surplus materials, the total cost was reduced below Rs. 5,000. For this small sum an additional office, storeroom, sterilizing room, and new animal house have been erected, new tiled benches fitted in the main laboratory, and the former sterilizing and store-rooms converted into an additional laboratory which is also fitted with ferro-concrete tiled bench, sinks, and gas and water fittings complete. The new rooms thus made available have been furnished on laboratory account.

This extension has completely removed the difficulties due to lack of space mentioned in the last annual report, and has made it possible to carry out an extended programme of research into the spread of hookworm disease, in addition to the studies already in progress on the transmission of plague, the incrustation of water mains, and the usual routine work of the laboratory.

2.—PLANT AND EQUIPMENT AVAILABLE AT END OF 1922.

The laboratory is exceptionally well equipped.

The equipment includes two electrically driven centrifuges; a battery of four electrically heated thermostats capable of maintaining temperatures from 37° C. to 300° C., power driven vacuum and pressure pumps; a large gas heated sensitive thermostat with motor stirring apparatus; three incubators of large capacity, two working at 37° C. and one at 22° C., a first quality microscope, and all the usual minor equipment of a bacteriological laboratory. The large 300 cc. high speed centrifuge is nearly worn out and will probably need to be replaced this year.

Attention is drawn to the fact that two of the best microscopes and practically all the books of reference in use in the laboratory are the personal property of the Bacteriologist, and will need eventually to be replaced at an approximate cost of Rs. 1,500.

3.—STAFF.

Permanent.

Dr. L. F. Hirst, Bacteriologist; Mr. C. A. Woutersz, Assistant to Bacteriologist; Mr. J. A. A Fernando, Clerk and Storekeeper; * Vacant, Junior Laboratory Assistant; Jubial Caldera, Laboratory Attendant; Don Richard, Peon; N. L. M. Perera, Rat-dissecting Cooly.

Temporary.

D. C. A. Hettiaratchi, Laboratory Attendant; Hendrick Fonseka, Cooly.

The expression "Laboratory Attendant" is equivalent to the "Laboratory Assistant" of the Government laboratories. Both attendants are highly trained. The permanent attendant is experienced in the use of the microscope as well as the manufacture of all kinds of culture media. Both coolies are trained in rat dissection, and both also take part in the cleansing and disinfection of the premises. Additional daily paid coolies are engaged when necessary.

A special assistant and extra laboratory attendant were temporarily engaged in September to assist me in the research on the epidemiology of hookworm disease. Their salaries were paid out of Rockefeller Foundation Funds.

4.—ORGANIZATION.

The work may be classified under two headings, Routine and Special.

The former class of work is carried out by a specially trained staff under my supervision, the latter is of the nature of research work and can only be done by a fully qualified Bacteriologist. The routine work can be satisfactorily carried on in my absence under the supervision of my experienced assistant. The special work has to be suspended when I am on leave in Europe.

The routine work mainly consists of the examination by standardized methods of specimens sent in by medical practitioners resident in the city, by the officers of the Public Health, Veterinary and Sanitary Departments, the Port Commission, and by trained collectors sent out by the laboratory.

* This post was revived on February 7, 1922.

MUNICIPAL BACTERIOLOGICAL LABORATORY.

MUNICIPAL BACTERIOLOGICAL LABORATORY.

FLEA INDEX RAT CAGES.

RAT DISSECTION.

Details are shown in the tabular statements contained in this report. Enteric and anti-influenza vaccines are prepared from time to time by the Bacteriologist, and are made available to the public.

The nature of the special work carried out by the Bacteriologist is sufficiently indicated in the various reports from this laboratory published in scientific journals. See also under the headings plague, anchylostomiasis, and water supplies, in this report, and those for 1921 and 1922.

5.—Method of Work.

Routine Clinical Specimens.—A simplified reliable technique is used for the examination of routine specimens in general in preference to more elaborate, more exact, and less foolproof methods only suitable for the use of a fully trained Bacteriologist.

When complex methods are necessary the test is done by the Bacteriologist. Thus the subordinate staff are trained in the use of Delepine's drop method for the diagnosis of typhoid by Widal's reaction. But if the patient has had anti-enteric inoculation the Dreyer technique and the Oxford standard emulsions are employed by the Bacteriologist.

The cultures and reagents in all tests used are systematically controlled by the Bacteriologist.

Bacteriological Examination of Water.—The Bacteriologist employs the separate species method as modified by him * for the examination of samples from public wells and the Labugama Reservoir. The routine town water samples taken from standpipes are examined by the Assistant by a simplified method for determining the proportions of lactose fermenting, indol forming B. coli present.

Plague.—The incidence of plague is investigated on three lines in this laboratory.

(1) Material from the post-mortem examination of human cases suspected to have died of septicæmic plague is brought by the Sanitary Inspectors to the laboratory where it is examined as soon as possible by the microscope, by cultivation, and by animal inoculation tests.

(2) An equal proportion of all the rats caught in the district of each rat destruction overseer is sent daily to the laboratory for examination. Also all dead rats and all claytonized rats obtained in any part of the city. A full description and scientific discussion of the methods used will be found elsewhere†. If, however, the decline in the proportion of septicæmic cases continues, it may be necessary to modify these methods so as to bring them into line with usual Indian routine practice, which relies solely upon the observation of the naked eye appearances of the dissected rat carcase for a diagnosis of plague. This method is much less exact than that in use at present, but more expeditious. It would be possible by this means to examine all the rats caught in the city, *i.e.*, on an average of about five hundred per day instead of eighty-eight. This would involve a saving in cost of materials but an increase in cost of cooly labour for rat dissection.

(3) The rat fleas are collected systematically on three days a week from the rats caught alive in all parts of the city. The rat-traps are enclosed in canvas flea-proof bags to guard against the effects of sunlight, which would cause the fleas to drop off before they reached the laboratory.

The flea index, *i.e.*, the average number of fleas per rat is now estimated solely from counts on *Rattus rattus*.

Formerly fleas were also collected from *Epimys norvegicus* for the purpose of a separate estimation of the flea index. This practice has now been abandoned owing to the increasing scarcity of *Epimys norvegicus*. Moreover, I find the subordinate staff are apt to confuse this rodent with a species of mole rat which is common in many parts of the city.

Rise in the flea index is usually correlated with an increased incidence of both rat and human plague.

It may be pointed out that the routine methods now employed for the examination of plague-infected rodents and samples of water were all worked out by research in this laboratory. The researches carried out in 1921–22 lead me to believe that a continuous flea survey of the rats of Colombo on organized routine lines will yield results of the greatest interest and value.

I have accordingly worked out a routine technique for collecting and examining fleas which can be relied upon to give satisfactory results in the hands of a conscientious laboratory assistant.

The Municipal Veterinary Surgeon has organized his work of rat collection in such a systematic manner that the task will be considerably simplified.

Thus it will be realized that the research of one year leads to the routine method of the next.

6.—Diagnostic Service.

I hope to be in a position to extend the diagnostic service when the training of the recently sanctioned extra assistant is sufficiently advanced.

There is a growing tendency to diagnose simple continued fevers as "paratyphoid" and intermittent fevers as malaria on clinical grounds alone.

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* The Bacteriology of the Colombo Town and Well Waters Special Conference. Number of Indian Journal of Medical Research. 1914. L. Fabian Hirst.

† A Report on the Outbreak of the Plague in Colombo 1914–1916. Journal of Hygiene. Vol. XV., No. 4, February, 1917. W. M. Philip and L. F. Hirst.

From a scientific point of view these infections can only be definitely diagnosed by the isolation of the causative organisms of paratyphoid from the blood or the excreta, or the observation of the malarial parasite in blood films.

Until a large number of blood cultures from cases of continued fevers have been systematically examined in the Colombo hospitals, it will be impossible to estimate to what extent infection by paratyphoid A, B, or C is actually prevalent in Colombo. The efficiency of the locally prepared anti-enteric vaccine could probably be increased if we were provided with this information.

Most of the agglutination tests for enteric carried out on behalf of the Public Health Department were performed on milk vendors previous to the issuing of licenses. Those applicants for licenses, whose blood serum has any agglutinative effect on Bacillus typhosus, are put through the usual series of tests for enteric bacilli in the excreta.

I should like to point put once again how great a handicap to the investigation of the nature and incidence of enteric fevers, dysentery, and like infections is the lack of a modern infectious diseases hospital readily accessible from this laboratory.

Distribution of Clinical Specimens.

	Examined for.	Number received.	Number Positive.
Diagnostic service for practitioners ...	Enteric ...	69	14
	Tuberculosis ...	35	11
	Dysentery ...	8	1
	Diphtheria ...	7	3
	Hookworm ...	48	25
	Various ...	56	41
Municipal Enteric Hospital ...	Enteric ...	110	36
	Human plague ...	2	0
	Malaria ...	11	3
	Dysentery ...	1	0
Public Health Department ...	Enteric ...	438	3
	Human plague ...	59	21
	Dysentery ...	7	2
	Various ...	4	1
	Hookworm ...	5	2
		860	163

Of the 617 enteric specimens, 526 comprised finger bloods for Widal's reaction, 52 fæces, and 39 urines. *B. typhosus* was isolated on two occasions from fæces. No paratyphosus A or B were isolated this year.

(*a*) *General Distribution of Specimens examined during 1922.*

	Number received.
Clinical specimens	860
Town water	157
Other waters	5
Goats' blood for anthrax	238
Rat fleas for species distribution	2,580
Soil for hookworm larvæ	110
Miscellaneous	3
Rodents for plague :—	
Port Commission	7,047
Veterinary Department	23,806
Public Health Department :—	
Rats found dead	155
Rats killed by Clayton machine ...	2,689
Dead cats	2
Dead squirrel	1
Veterinary Department :—	
Rats for flea index	3,456
	41,109

7.—Plague.

There were several unusual features connected with the bacteriology and parasitology of plague in 1922.

Epizootics of unusual severity occurred at an unusual season of the year in certain quarters of Slave Island and Borella, which are usually comparatively free from plague.

These epizootics seem to have been associated with the distribution of a particular consignment of plague-infected cattle fodder and horse forage.

The strain of B. pestis was of unusual virulence, as may be judged by the fact that a small dose sufficed to kill a 300 gm. guinea pig in less than 24 hours.

Moreover, as already noted, the plague infection spread to two cats and a squirrel. Squirrel plague has been recorded from Ginigathhena in 1917 in association with the Nawalapitiya outbreak.

This species of squirrel is extremely susceptible to infection with pure cultures of B. pestis. No fleas have yet been found on these squirrels.

The significance of the presence of an unusual species of flea in these infected zones is discussed in the succeeding section.

(*b*) *Distribution of Rodents examined for Plague.*

Species.		Number examined.	Number Infected.	Percentage Infected.
Trapped rats ...	R. rattus ...	22,562	3	0·01
	R. norvegicus ...	5,294	6	0·11
	M. musculus ...	2,181	0	—
	Bandicoots ...	7	0	—
Rats found dead ...	R. rattus ...	63	17	26·98
	R. norvegicus ...	110	20	18·18
	M. musculus ...	24	2	8·33
	Bandicoots ...	1	1	—
Rats killed by Clayton machine ...	R. rattus ...	1,135	4	0·35
	R. norvegicus ...	1,198	3	0·25
	M. musculus ...	1,119	0	—
	Bandicoots ...	3	0	—
		33,697	56	0·16

The 199 mummified rats received for examination are not included in the above.

130 specimens of the musk "rat" *Crocydura cærulea* were brought to the laboratory. This insectivore is practically immune to plague. Strictly speaking, it should not appear in the plague returns.

(*c*) *List of Rodents found in Colombo by Officers of Sanitary Departments.*

FAMILY. MURIDÆ.

Sub-family. Gerbillinæ.

Species. *Tatera Ceylonica.*—The Ceylon gerbil. Fairly common around Colombo, found on the Galle Face.

Sub-family. Murinæ.

Species. *Bandicota malabarica.*—The Malabar bandicoot. Common in gardens.

Gunomys gracilis.—The Ceylon mole rat. Common around Colombo in gardens, paddy fields, &c.

Rattus rattus Kandiannæ.—The Ceylon house rat. The common bungalow rat.

Rattus rattus rufescens.—The Indian house rat.

Rattus rattus nemoralis.—The large Ceylon tree rat. Only a large form of the last species.

Rattus rattus alexandrinus. } Ship and sewer rats. Fairly common round the docks
Epimys norvegicus. } and not indigenous.

Mus dubius.—The Indian house mouse. The common mouse.

Leggada booduya.—The Southern field mouse. A small white bellied field mouse which should be found in the paddy fields around the town.

FAMILY. SCIURIDÆ.

Sub-family. Sciurinæ.

Species. *Fonambulus palmarum favoricus.*—The Colombo palm squirrel. The submontane palm squirrel of the low-country wet zone.

As already pointed out in previous reports the term "*Rattus rattus*" in the plague returns includes several varieties of domestic rats, and the term "*Rattus norvegicus*" at least two varieties of sewer and mole rats.

(*d*) *Monthly Flea Index.*

Month.	Number of R. rattus examined.	Flea Index.	Number of R. norvegicus examined.	Flea Index.
January ...	157 ...	2·00 ...	55 ...	4·18
February ...	165 ...	1·57 ...	126 ...	2·46
March ...	220 ...	1·47 ...	149 ...	1·47
April ...	193 ...	1·20 ...	114 ...	1·45
May ...	229 ...	1·34 ...	100 ...	1·92
June ...	256 ...	1·08 ...	117 ...	1·39
July ...	209 ...	1·34 ...	62 ...	1·39
August ...	193 ...	1·46 ...	62 ...	1·46
September ...	288 ...	1·13 ...	73 ...	1·06
October ...	253 ...	1·42 ...	55 ...	1·61
November ...	209 ...	2·11 ...	— ...	—
December ...	171 ...	2·04 ...	— ...	—

8.—Distinction between various Types of Plague.

Considerable confusion of thought still prevails among many physicians as to the nature of the distinction to be drawn between the various types of plague.

The clinical types are essentially two. The pneumonic and the bubonic.

The pneumonic type is the most common in cold climates and the bubonic in warm.

In Alexandria bubonic plague prevails during the warm weather, the pneumonic type only appearing in the short winter season.

Pneumonic plague is directly infectious from man to man by inhalation of particles of infected sputum. Bubonic plague is spread almost entirely by insect carriers. The term "bubonic" is in reality a misnomer. Visible or easily palpable buboes only develope if the case lives several days. Death at an earlier period may be brought about in two distinct ways: (1) By rapid multiplication of the B. pestis in all the tissues of the body and death from *septicæmia*. The internal organs, especially the lungs, are congested. Hæmorrhages into the tissue are commonly observed. The glandular enlargement is slight. There is nothing external to indicate the nature of the disease, which can only be definitely diagnosed by bacteriological examination. This type is characteristic of plague as it occurs in Colombo, and is known as Septicæmic plague. (2) At a still earlier stage by an overwhelming toxæmia. In such cases the patient may die within a few hours of the onset of symptoms. Few plague bacilli are found in the tissues. Only very virulent strains of plague are capable of killing thus. Practically no change in the tissues may be visible to the naked eye.

From an epidemiological point of view the distinction between the ordinary "bubonic" type and the "septicæmic" is most important.

An epidemiologist would define as "septicæmic," that type of plague in which sufficient bacilli are present in the peripheral blood to infect a flea or other insect carrier of the disease. The capacity of the flea's stomach is about ·5 cubic millimeter. In other words, a case of plague is epidemiologically septicæmic when there are more than 2,000 plague bacilli per cubic centimetre of blood.

The blood of bubonic cases of plague often contains plague bacilli in smaller quantities than this, the number being greatest just before death takes place.

Table showing change in Type of Plague Infection.

Plague among "Rattus rattus."

	1914.	1915.	1921.	1922.
Septicæmic type ...	61	20	12	7
Bubonic type ...	66	13	30	19
Percentage septicæmic ...	45·08	60·60	28·60	26·92

Plague among "Rattus norvegicus."

	1914.	1915.	1921.	1922.
Septicæmic type ...	22	9	4	6
Bubonic type ...	84	21	9	21
Percentage septicæmic ...	20·75	30·0	17·4	22·22

Human Plague.

	1914.	1915.	1921.	1922.
Septicæmic type ...	247	81	70	57
Bubonic type ...	166	58	114	79
Percentage septicæmic ...	59·8	58·27	38·04	41·91

9.—Parasitology of Plague.

A summary of the long series of observations on the parasitology of plague made in this laboratory since 1912 will be found in last year's annual report.

It may be of interest to describe how I was led to the conclusions reached and to explain their significance more fully.

My first observations on the ectoparasites of rats were made in 1911, in the laboratories of University College Hospital Medical School, during my term of office as Second Assistant Bacteriologist to that Institution, in collaboration with Mr. Stanley Hirst, Acarinologist to the British Museum. The rats examined were from the port of London.

Particular attention was paid to the little known Acarine parasites so constantly found in the fur of rats all over the world.

In 1921 I continued these observations in Colombo, sending home collections of ectoparasites to the British Museum.

It is possible that *Dermanyssus muris*, one of the new species described by Stanley Hirst, from these collections might convey plague to rat and man, since it is a blood sucker able to attack them both. If so, some of the classical work on the transmission of plague by fleas is open to criticism.

This mite, however, is relatively scarce and difficult to breed.

Attention was accordingly concentrated on the significant discovery that the rat fleas in my collection belonged to a new species, never previously found on rats, viz., *Xenopsylla astia*. This species was first captured on an insectivore in Rangoon, and was first described by Rothschild in 1911.

The genus Xenopsylla comprises a number of different species of flea. *X. cheopis* is almost cosmopolitan in its distribution in the hotter parts of the world. It is the common Indian rat flea and the best known plague carrier. *X. astia* is met with on the rodents of India, Mesopotamia, and Ceylon. *X. brasiliensis* is found on the rats of West Africa and South America and of the uplands of Peninsular India. *X. chephrenis* is the flea of the desert rat of Egypt.

Xenopsylla astia seems to be more closely allied to *X. nubicus* than to *X. cheopis*.

For many years epidemiologists in India confused both *X. astia* and *X. brasiliensis* with *X. cheopis*, being under the impression that there was only one representative of the genus on Indian rats, whereas in reality there are three.

I am indebted to Rothschild for the identification of the first three collections of rat fleas. Rothschild's first report on Colombo rat fleas was received in August, 1912. Early in 1913 I read an account of the Plague Commissioners' researches on plague in Madras city. The Commissioners were unable to suggest a satisfactory explanation of the immunity of Madras city from plague. An immunity almost as complete as that of Colombo up to that date. The Commissioners identified the rat fleas of Madras, and of all other parts of India, with a few insignificant exceptions as *X. cheopis*. This error was natural enough in 1912, so soon after the discovery of *X. astia*, but it is difficult to understand why they ignored the observations of Rothschild and the writer when writing their later reports on the spread of plague in India, published in 1915 and 1917; more especially since the Commissioners state that they were not satisfied with their explanation of the phenomena noted, and suggest the possibility that some unknown factor was in operation. The Commissioners do not appear to have attempted to transmit plague experimentally from rat to rat by means of Madras fleas. The Madras rats being more highly susceptible to plague infection than those of any other part of India, are particularly suitable for such experiments.

It occurred to me after reading the Commissioners' reports that the true explanation of the remarkable immunity of Colombo and Madras from plague might be that *X. astia* was not a true plague-carrying flea, and that the rat fleas of Madras might have been wrongly identified.

An analogy from the epidemiology of malaria may help to elucidate the idea. Till recently Colombo was practically free from malaria-carrying mosquitoes, and also from indigenous malaria. The mosquitoes now present may be represented by three types. *Anopheles culicifacies* or *listoni* which are dangerous carriers associated with epidemic malaria; *A. rossii* which have never been proved to carry the disease, and *A. sinensis* which only carries it occasionally under particularly favourable conditions. *X. cheopis* corresponds to *A. culicifacies*, *X. astia* to *A. rossii*, and *Pulex hominis* to *A. sinensis*.

As a first step to the testing of this hypothesis, I sent to Madras and to a plague-infected city of India for collections of rat fleas.

Professor W. S. Patton, then of the Guindy Institute, Madras, was kind enough to procure for me a collection of 788 rat fleas from Madras city. The control collection did not come to hand. I had already found that *X. astia* bit man reluctantly at tropical temperatures. When Rothschild reported that all the Madras fleas were *X. astia*, I put forward the hypothesis that *X. astia* was a relatively inefficient porter of plague at the next meeting of the British Medical Association (November 13, 1913) and suggested that further investigation into the geographical distribution of rat fleas would throw light upon the epidemiology of Oriental plague. The Chairman, Dr. Aldo Castellani, preferred, very reasonably, to suspend judgment upon this new hypothesis till the results of further investigations were available.

I have had the opportunity of discussing this hypothesis personally with entomologists, epidemiologists, including several members of the Plague Commission (1914), and bacteriologists.

The entomologists being familiar with the great diversity in the habits of closely allied species of insects, adopted a sympathetic attitude towards these new ideas and gave me every encouragement to pursue this line of investigation.

F. W. Cragg (1920) has clearly expressed the entomological standpoint in a recent communication giving the results of an extensive survey of the fleas occurring upon the rats of India. He drew attention to the inadequacy of the Plague Commissioners' explanations of the anomalies in the distribution of plague in India, and showed that *X. astia* predominates in those parts of India which are relatively free from epidemic plague. Cragg's observations have been given widespread publicity, and go far to confirm my hypothesis.

The epidemiologists considered that *X. astia* had not been clearly differentiated from *X. cheopis*, the common Indian plague flea. Rothschild disposed of this objection in 1914 by clearly exhibiting the distinctions between the three species of *Xenopsylla astia*, *cheopis*, and *brasiliensis*, which actually occur on the rats of India. See also the photomicrographs in my most recent report. I have demonstrated that *X. astia* and *X. cheopis* breed true.

The bacteriologists' criticisms were based on a too rigidly mechanical conception of the mechanism of the transmission of plague by fleas.

The experimental results obtained in this laboratory, first reported by Philip and Hirst in 1917, and subsequently amplified in later reports by the writer and also the researches of Martin and Bacot (1914) carried out in the Lister Institute in London, suffice to invalidate these remaining objections.

Nevertheless, we look in vain through various reports to the Government of India on plague incidence and plague preventive measures for any reference to the observations of Rothschild and the writer.

The plague preventive measures hitherto adopted by the Government of India to control the spread of plague are based on the belief that the known facts are sufficiently accounted for by the influence of climatic conditions on the vitality and reproductive power of rat fleas in general; whereas the evidence is steadily accumulating that the spread of plague in the Orient is primarily governed by the distribution of a particular species of rat flea and, secondarily, by the effects of climate on the development and activities of this flea.

The efficiency of a particular flea as a vector of plague may be investigated on three lines:—

(1) By determining the correlation between the geographical distribution of the flea and the distribution of plague.

(2) By investigating its biological aptitudes, particularly, the number of hosts which it will paraciticise, its viability, and reproductive powers under different climatic conditions, and the extent to which it will wander away from the body of its hosts.

(3) By experimental tests of its power of transmitting the virus of plague under properly controlled conditions, between animals infected with septicæmic plague, and animals highly susceptible to plague infection.

The investigations on these lines in this laboratory began in June, 1913, and were continued at intervals till February, 1915. They were resumed after my return from war service in 1920 and are still in progress.

1.—*The Distribution of Colombo Rat Fleas in relation to Plague.*

X. cheopis was found in the original locus of rat and human plague for the first time shortly after plague broke out in Colombo.

The preliminary results of a comparison between the species of flea occurring upon rats in the plague and non-plague areas were published last year.

A systematic survey of the rat fleas of the city is now in progress, with a view to determining the distribution of the two species within the city limits, and the relative proportion in which they occur upon the rats of each locality. The results will be corrected to the estimated rat population in each district.

A remarkably close relationship has been disclosed between the distribution of *X. cheopis* and that of human and rat plague.

There seems to be both an absolute and a relative increase of *X. cheopis* in the epidemic plague centres.

X. cheopis abounds particularly in the vicinity of grain and forage stores.

The proportion of *X. cheopis* found on rats caught in the Chalmers granaries and the Customs premises is much higher than elsewhere. Evidence is accumulating to show that this flea is being constantly imported into Colombo from plague-infected ports of India and Burma.

Rapid multiplication of rats such as occurs in grain godowns favours a general increase in susceptibility to plague infection. If a plague-carrying flea be introduced in sufficient numbers into such a community of rats a sharp epizootic is likely to follow.

Sporadic outbreaks of plague in premises outside the endemic area seem to have the effect of increasing the proportion of *X. cheopis* on the surviving rats of the neighbouring locality. It has been observed in Java that a local epizootic is followed by a temporary rise in the average number of fleas found on the rats surviving.

Recently a species of *Ctenocephalus* was found in plague houses in Borella. Several specimens were trapped on tangle-foot papers spread round cages containing live rats. The same species also attacked man in the plague houses in Galle during the recent outbreak there. The power of this species to transmit plague among rats has not yet been investigated in Colombo. It has only twice been captured on the body of Colombo rats.

The habitat of fleas of different genera and species is subject to great variations. Some fleas spend most of their time on the body of their host, others in the host's nest. So that the proportion of fleas caught per rat, *i.e.*, the estimation of flea index, is only of scientific value when used for the comparison of the prevalence of particular species under varying climatic conditions. Because a plague-carrying flea is rarely captured on the body of rats, it does not necessarily follow that it is not abundant in plague-infected premises.

Several specimens of *Pulex hominis* captured by Sanitary Inspectors in plague houses have been brought to the laboratory. *Pulex hominis* is a proved plague carrier. The importance of this flea in relation to the spread of septicæmic plague from man to man is probably underestimated.

Plague flea surveys are of particular value for making out endemic and epidemic zones.

Such surveys cannot be used for predicting sporadic outbreaks due to the importation of small groups of *X. cheopis* from the endemic area in foodstuffs, or amongst the clothing and personal effects of individuals. Mathematicians should be able to deduce the advantages and limitations of the method in a particular set of circumstances by a suitable application of the calculus of probability, to the data provided by a series of such surveys.

2. *Readiness with which X. astia bites man.* . . . In 1913 a series of observations were made on the readiness with which *X. astia* feeds on man and on the rat under different conditions. It was found that this flea bites man reluctantly at temperatures over 80° F. If the fleas be starved nearly to the point of death, a small proportion can be induced to bite upon the human skin under tropical conditions. On the other hand, even newly bred fleas of this species will nearly always feed upon a rat within half a minute of being placed upon its skin. The contrast between the behaviour of this flea on the skin of rat and on that of man is very striking at a temperature of 85° F. While the rat is eagerly bitten, the human skin often seems actually repellant to the flea. There was no great difference in the relative humidity of the atmosphere during these experiments. I do not know whether marked differences in atmospheric humidity have any noteworthy effect on the biting powers of fleas.

It would be highly interesting to know if temperature variations have any marked effect on the activities and biting powers of *X. cheopis*. No exact observations seem to have been made on this point. The experimental inquiry could not readily be conducted in Colombo, but the abrupt rise in the number of cases of plague which frequently occurs in this city shortly after a sudden decline in the mean minimum temperature seems to suggest that *X. cheopis* attacks man more frequently at lower temperatures.

It seems only reasonable to suppose that this would be the case since *X. cheopis* is best adapted to a somewhat lower range of temperature than that which usually prevails in Colombo.

My published report that *X. astia* bites man with reluctance at temperatures over 80° F. in the tropics appears to have been amplified by various authorities into a statement that this species does not bite man at all and therefore on this account alone cannot have any relation to human plague. This is incorrect. At the lower temperatures prevailing during the plague season in Colombo and at up-country stations a large proportion of starved *X. astia* can be induced to bite when placed upon the human skin. This species, however, seldom attacks the plagues prevention staff, when working in plague-infected houses. I have refrained hitherto from publishing details of my observations on the biting powers of *X. astia* because of my inability to breed a sufficient supply of *X. cheopis* for control experiments under parallel conditions. This difficulty was overcome in the last months of the year under review. A fresh series of observations on the biting powers of the two fleas under parallel conditions is nearly completed at the time of writing.

The full range of hosts which *X. astia* can paraciticize is not yet known. It is certainly found on many Ceylon rodentia, including all those in the list given above, and on some insectivores, such as the "musk rat" *Crocydura cœrulea*. It seems certain, however, that *X. astia* is not adapted to such a great variety of hosts as *X. cheopis*, nor is it likely that its distribution is nearly so cosmopolitan as this well known plague-carrying flea.

It is probable that it ranges less widely in search of food. The bionomics of *X. astia* have not been investigated in great detail for lack of the time necessary for exact observations. Under average conditions the egg hatches out in about three days, the larval stage lasts about a fortnight and the adult emerges from the cocoon about the 26th day from the laying of the egg. Very few eggs are laid, or larvæ hatched out during the hot dry weather.

Its activity increases as the atmospheric temperature falls within the range 80° F. to 70° F., but its average length of life seems shortened at the cooler temperatures prevalent up-country. At high temperature, 85° F. and over, the flea becomes inert and sluggish in its movements.

In the months of December and January it may live as long as ten days without feeding or even longer if newly bred. In hot and dry weather *X. astia* like *X. cheopis* requires frequent meals of blood to enable it to survive for any length of time.

A comparison between the proportion of *X. cheopis* and *X. astia* found during the hot and cool weathers in Colombo shows clearly that *X. cheopis* is more unfavourably affected by hot weather than *X. astia*.

Cragg has made similar observations on fleas from Bellary in Madras.

It would be useful to ascertain the monthly incidence of both species of flea on rats in the plague area. To obtain sufficient data, however, it would be necessary to devote the services of two attendants to a daily flea collection at the depôt.

I find that *X. cheopis* can only be bred successfully in the laboratory during the cooler months of December and January.

It would appear, therefore, that the seasonal variations in plague incidence can be attributed to the effect of climatic conditions upon the activities and reproductive power of *X. cheopis*.

The immunity of Madras from plague may be attributed partly to the fact that the population mainly subsists on locally-grown rice, so that little grain is imported from plague-infected districts, partly to the effect of the long hot weather on the breeding of *X. cheopis*. Plague would probably break out in Madras city if a sufficient number of *X. cheopis* were transported there during the cool weather.

The observations of Cragg and the writer on the distribution of *X. cheopis* in Madras lead to the conclusion that the long immunity of Colombo from plague must be attributed to the existence of a broad *Astia* zone in the hot dry lowlands of Madras, through which infected *X. cheopis* and its eggs, larvæ and cocoons had to pass before they could reach Colombo amongst rice and grain exported from South Indian ports.

The larvæ of *X. cheopis* can only be expected to survive this passage during perhaps two months in every year.

Infected adult fleas would die out within the first few days of being transported in trains carrying foodstuffs across such country.

In November, 1913, however, plague broke out on the sea coast of Madras at Negapatam, a port within one day's sail of Colombo. In all probability numerous *X. cheopis* in various stages of development were present amongst the cargoes of grain which reached Colombo from Negapatam late in December, 1913, and early in January, 1914, at a time when the Negapatam epidemic was at its height. Some of these fleas must have been infected with plague.

During February, 1914, a large proportion of *X. cheopis* were found by the writer on rats caught in Sea street. The plague first broke out in this locality during the month of January, 1914. *Xenopsylla cheopis* may possibly have reached Colombo in small numbers at earlier periods though none were actually found. The probability is, however, that even under the most favourable circumstances, only a small proportion of these fleas survive the hot weather in Colombo.

Unfortunately there is evidence that *X. cheopis* has gained a footing in up-country districts, where the climatic conditions are much more favourable to its multiplication.

3. *Experiments on the Transmission of Plague from Rat to Rat by means of X. astia.*—When I first suggested that *X. astia* was not a true plague flea I imagined that the full import of the new hypothesis would be immediately realized, and that experienced epidemiologists would make further observations on the distribution of the flea in relation to plague and perhaps investigate the problem experimentally.

Cragg, as stated above, undertook the former task in 1919.

In 1914–1915 some preliminary experimental observations were made in this laboratory. The results were highly suggestive but not fully controlled. Brief reference was made to them in 1917, in the above mentioned report by Philip and Hirst. On my return from war service in 1920, I again took up the question. Detailed results of all but the most recent observations are published in the Indian Journal of Medical Research, January, 1923. The results of the more recent experiments are still more convincing and will be reported later. Theoretically, *X. astia* should be capable of occasionally carrying highly virulent strains of plague to highly susceptible animals. Practically, I have never succeeded in transmitting plague by means of this flea, though experiments with *X. cheopis* under the same conditions have been uniformly successful.

I am fully conscious, however, that these results are not applicable to all conditions and need to be repeated elsewhere. In view of the greater activity of *X. astia* at low temperature it would be interesting to carry out similar observations in the hill country at atmospheric temperatures several degrees lower for comparison with those made in Colombo.

The conclusion that *X. astia* is not a true plague-carrying flea is of great practical importance.

The concentration of plague preventive measures on the zones where *X. cheopis* abounds or is introduced sporadically will not only result in a great economy of sanitary effort, but will greatly improve the prospect of completely eradicating the disease from the locality affected. The smaller the *cheopis* zone the greater the prospect of complete success. Both rats and fleas in a limited area can be dealt with cheaply and expeditiously by the measures devised by Dr. Marshall Philip and employed with signal success not only in Colombo, but elsewhere in Ceylon. It is only where large tracts of country abound in insect vectors of disease that the task of totally eradicating that disease may prove to be beyond the resources of the State, and it may be necessary to fall back upon palliative measures such as those generally employed in India in dealing with plague.

The epidemiology of malaria may again furnish an example of the principle involved. Where efficient anopheline vectors of malaria occur in great numbers over a large area, the introduction of human carriers of a suitable species of malarial parasites may result in periodic and intractable outbreaks of malaria which resist all but the most heroic and costly measures applied on a large scale. On the other hand, where only a few breeding places of a malarial mosquito occur in a given area, in which a harmless variety of anopheline predominates, then simple and cheap measures will often suffice to eradicate the malarial infection entirely from that locality. Provided always that these measures are based on scientific knowledge of the habits of the mosquito, and are thorough and complete. Half measures modified to meet the convenience and the prejudices of the local inhabitants will in such a case fail to do more than affect a temporary diminution of the incidence of the disease and are in the long run far more costly. It may be argued that in the case of plague the proper means of scientific control are impracticable and unduly oppressive. Personally, I am convinced that the inhabitants of a plague-infected locality will cheerfully co-operate with the authorities in carrying out plague preventive measures, once they are convinced that these measures are likely to be successful in suppressing a disease which imperils their lives, and which is known to have destroyed more than ten million of their brethren in the neighbouring continent since 1896. The members of the various communities living in the areas affected only require to be convinced by public-spirited and enlightened men of their own community that the authorities are working solely in the interests of the public health, and for the welfare of each community concerned.

The gigantic labours of many medical scientists in India, more especially Glen Liston, have done much to put our knowledge of the epidemiology of plague upon a firm foundation. But many tasks remain to be completed before these labours can come to full fruition. It is to be hoped that the anti-plague policy of the Government of India will be suitably revised, so as to take into account recent advances in our knowledge. It is probable that the distribution of the insect vectors of plague will be found to be much the same in southernmost India as in Ceylon, and that the preventive measures employed in Colombo will be equally effective there.

A revised policy for the prevention of plague should combine the measures so ably set forth in a recent memorandum by Dr. Norman White, with more radical proceedings aiming at the complete suppression of the disease, wherever it breaks out sporadically as a result of the introduction of the plague-carrying flea into those parts of India where *X. cheopis* is not indigenous. Increased attention should be paid to the control of the transport of grain from plague-infected centres in India and Burma, to other countries, and to the destruction of the fleas harboured in all stages of development amongst such grain, by the improved methods now available.

10.—Water Supply.

Further experiments have been carried out with the coke treatment of the town water for the prevention of the incrustation of the mains.

In this series of experiments the crust forming water was caused to pass through two cylindrical receivers in parallel and then through glass pipes at the same uniform rate of flow. One cylinder contained coke treated in a variety of ways, the other control cylinder a variety of neutral rough surfaced substances, such as broken coral. In some experiments the effect of one kind of coke contained in one cylinder was compared with that of another kind in the control cylinder. The results obtained are in conformity with the previous observations with the experimental plant laid down in the reservoir grounds. The laboratory method gives more rapid results, and the conditions of the experiments are under better control.

I have succeeded, as a result of these observations, in further increasing the efficiency of the process and of obtaining a more lasting effect from the coke.

I note, however, that many patents have recently been taken out in European countries for treating coke and other carbons with a view to increasing its chemical activity. It is possible that some of these inventors have devised a method more suitable than my own for the purposes in view.

I propose, therefore, to institute inquiries into the matter in all its aspects during my absence on leave out of the Island. I hope to visit public works where crude coke is already employed for the removal of excess of iron from water supplies and where other substances are used for oxidizing ordinary labile organic matter in water supplies. The experience already gained in plants of the above description might be of value in dealing with the special problem to be solved to Colombo. I will report the results of such inquiries on my return to duty.

In the meantime I understand that the operation of raising the Labugama dam has already commenced. This work should effect not only an increase of the supply of water available to the public at all times of the year, but a diminution of the rate of incrustation of the mains by enabling the water to be drawn off at levels which contain less iron in solution, and fewer crust forming organisms.

It would seem that in any case the question of the advisability of installing coke strainers for the additional treatment of the supply must be postponed for consideration at a later date.

11.—Hookworm Disease.

A research is now in progress into the survival of hookworm larvæ in the Colombo sewage works and in different classes of Ceylon soils.

New methods have been devised for isolating hookworm larvæ from soil and distinguishing them from certain other larvæ of similar appearance.

The special expenses of this research are being provided out of Rockefeller Foundation Funds on the recommendation of the International Board of Health.

It follows that I am not at liberty to publish the results till the report, which is now approaching completion, is in the hands of officers of the Board in New York.

Interesting results have been obtained, which throw considerable light on the epidemiology of hookworm disease.

L. F. HIRST,
Municipal Bacteriologist.

March 17, 1923.

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