1919.

NEW ZEALAND.

NEW ZEALAND EXPEDITIONARY FORCE.

HEALTH OF THE TROOPS IN NEW ZEALAND FOR THE YEAR 1918.

Laid on the Table of the House of Representatives by Leave.

MEMORANDUM for the Hon. the MINISTER OF DEFENCE.

Department of Defence, Wellington, 22nd April, 1919.

I HAVE the honour to submit a summarized report of the health of the New Zealand Expeditionary Force whilst in camps in New Zealand for the year 1918.

The health statistics have been worked on the estimated average annual strength.

R. S. F. HENDERSON, Surgeon-General,
Director-General of Medical Services.

NEW ZEALAND EXPEDITIONARY FORCE.

HEALTH OF REINFORCEMENTS FOR THE YEAR 1918.

Strength.—The total number of men who have been present in the training-camps during the year 1918 equals 24,434. The average strength was 9,181.

Admissions to Hospital.—The total number of admissions to hospital was 11,578, giving an admission-rate per thousand of 1,243, and a constantly-sick rate of 36·81, as against 410 and 12·49 in 1917.

Deaths.—There were 291 deaths from disease, of which 260 were in camp hospitals and 31 in civil institutions elsewhere. In addition there were 2 deaths from accident, of which 1 occurred out of camp, and 2 suicides, 1 of which occurred out of camp.

The total number of deaths in and out of camps of men on the strength of the Expeditionary Force was 295, equal to a death-rate of 12·07 per thousand on the total number, and 32·13 on the average strength.

The prevailing disease was influenza, which caused the chief mortality during the epidemic period, resulting in 262 deaths.

Cerebro-spinal meningitis was the cause of 16 deaths, of which 7 were contracted during the influenza epidemic and were complicated by influenza, and 2 died out of hospital.

Pneumonia was accountable for 1 death.

Health of the Camps.—As regards the four camps, the admissions and constantly-sick rate, based on the average strength, with the number of deaths, were as follows:—

Camp.	Average Strength.	Admissions.	Admissions per Thousand.	Constantly Sick.	Constantly Sick per Thousand.	Deaths in and out of Camps.		
						Disease.	Accident.	Suicide.
Featherston ..	5,674	5,674	1,000	148·63	26·19	172	1	1
Trentham	2,744	4,931	1,797	165·12	60·17	92	1	1
Narrow Neck ..	266	493	1,853	18·52	45·56	17	..	..
Awapuni	396	360	909	8·10	20·46	7	..	..

Venereal Disease.—There were 291 cases (of which 240 were admitted for gonorrhœa, 46 for syphilis, and 5 for soft chancre) during the year, as against 340 the previous year. This shows a total admission-rate of 31 per thousand for the year, as against 34 per thousand for the previous year.

Admissions for the various camps were as follows :—

	Gonorrhœa.	Syphilis.	Soft Chancre.
Featherston	95	10	4
Trentham	134	36	1
Narrow Neck	9	...	...
Awapuni	1	...	...
Hanmer	1	...	...

The ratio per cent. on the average strength of the camps is—Featherston, 1·9; Trentham, 6·2; Narrow Neck, 3·4; Awapuni, 0·2. The increased number of admissions for syphilis was largely due to the greater stringency in ordering any infected recruits into camp when showing any active signs of venereal disease.

Influenza.—Influenza was the chief cause of sickness and mortality during the year, accounting for 73·6 per cent. of all cases admitted to hospital and 73·67 per cent. of all the deaths.

In Featherston it accounted for 4,522 out of a total of 5,674 admissions for all causes; in Trentham, 3,227 out of 4,931; Narrow Neck, 432 out of 493; Awapuni, 253 out of 360; Hanmer, 43 out of 56; and Rotorua, 51 out of 64.

Narrow Neck, unlike the other camps, was free from influenza until October—all the more remarkable in that it was garrisoned entirely by Maoris and Islanders, men particularly susceptible to catarrhal diseases. This reflects credit on the sanitary administration of the camp authorities.

In the early part of October 226 cases occurred, but all recovered, the disease disappearing on the dispersal of troops to other localities by the 11th October.

Another severe epidemic commenced on the 28th October and continued to the middle of November, there being 14 deaths and 206 cases. This epidemic was of a severe pneumonic type, much more severe than the October epidemic. In addition 3 cases died out of camp at North Head Forts Garrison whose deaths had no connection with the camp itself. The above death-rate is a low one when compared with the death-rates of Natives elsewhere.

At Awapuni there was an outbreak of influenza in August—54 cases and no deaths; and again, 27 cases were admitted in October and 147 in November, the latter of a severe pneumonic type, with 6 deaths. The Principal Medical Officer considers the severe type of cases to have been introduced from Auckland on the 30th and 31st October and 1st November by men who had been on leave in that city.

In Trentham there seems to have been a preliminary epidemic of mild influenza in August (103), September (877), and October (484), with no deaths; followed by a serious epidemic of pneumonia influenza, which began on the 4th November, with 29 cases, and increased daily until the 10th November and then rapidly declined, with total number of admissions of 1,566 and 75 deaths, of which 5 occurred from cerebro-spinal meningitis as a complication. The epidemic was ascribed to week-end leave to Wellington; but 3 cases of the epidemic occurred on the 1st, 4th, and 5th November: 3 of these had arrived from Awapuni Camp on these dates. There was at Trentham a special prevalence of the influenza bacillus during the earlier epidemic, but in the November epidemic there was a decline in this and an increase of pneumonococci and streptococci bacilli.

In Featherston ordinary influenza prevailed in August, September, and October, altogether 1,187 cases having occurred, with 1 death. In the end of October, following on the advent of some Auckland recruits, the C1 Company at Tauherenikau Camp were noticed to have a more severe type, and on the 4th November the epidemic began during very bad weather. The admissions during this month were 3,174, the numbers showing a rapid decline towards the end of the month, until in December there were only 6 cases.

The weather at Featherston Camp largely contributed to the violence of the epidemic owing to the unprecedented wind-storms, accompanied by snow and sleet; in fact, the weather at both camps was the worst known for some years during October and November.

Full accounts are given by the Principal Medical Officers of the camps of the devoted work of the Medical Officers, Sisters, orderlies and voluntary-aid people, and of the combatant branches in aiding the sick and suffering; and it is due to Lieut.-Colonel Graham Robertson, Lieut.-Colonel Leahy, Lieut.-Colonel Gabites, and Major Sharman, aided by these others, that the epidemic did not spread more, and that so many very seriously affected were restored to health.

We have to deplore the deaths of Lieut.-Colonel Holmes, N.Z.M.C., Lieut.-Colonel Bey, N.Z.M.C., Major Sale, N.Z.M.C., Captain Christie, N.Z.M.C., Captain Wheeler, N.Z.M.C., Sister Wishaw, N.Z.A.N.S., and others of our camps who sacrificed their lives to duty's cause.

Measles.—Measles accounted for 248 admissions to hospital, of which 120 cases were German measles. Featherston had 138 cases and Trentham 110. There were no cases at Narrow Neck or Awapuni.

Cerebro-spinal Fever.—There were 43 admissions into camp hospitals, 36 at Featherston and 7 at Trentham. In addition there were 12 cases amongst men on leave.

Of the camp cases 23 were admitted during the influenza epidemic, and cerebro-spinal meningitis symptoms developed as a complication of influenza.

Captain J. W. Crawshaw, N.Z.M.C., has written a very able and instructive note on the cases treated by him in Featherston Camp, in which by a vigorous application of serum treatment he lost only 8 cases out of 36, equal to 22 per cent. The total percentage of deaths to attacks equals 31 per cent., a great improvement on previous years.

Diphtheria.—There were 4 admissions at Featherston; no deaths.

Pneumonia.—There were 15 admissions; 1 death.

Enteric Fever.—One admission; no deaths.

Alcoholism.—There were 9 admissions, as against 86 for the previous year, and 1 death—a great improvement, accounted for by the different class of recruits, those in 1917 being bachelors and those in 1918 being married men.

Scabies.—There were 159 admissions.

Tubercle of Lung.—There were 9 admissions; 2 deaths.

Other General Diseases.—There were 56 admissions; 1 death (from carcinoma of jaw).

Diseases of the Nervous System.—There were 71 admissions; 4 deaths (3 from apoplexy and 1 from epilepsy).

Mental Cases.—There were 13 admissions; no deaths.

Diseases of the Circulatory System.—There were 73 admissions; 2 deaths (1 from D.A.H. and 1 from V.D.H.).

Diseases of the Respiratory System.—There were 185 admissions; 1 death (from pleurisy).

Diseases of the Digestive System.—There were 422 admissions; no deaths.

Diseases of the Urinary System.—There were 52 admissions; 1 death (from diabetes).

Diseases of the Generative System.—There were 43 admissions; no deaths.

Diseases of the Organs of Locomotion.—There were 228 admissions; no deaths.

Diseases of the Connective Tissue.—There were 7 admissions; no deaths.

Skin-diseases.—There were 92 admissions; no deaths.

Injuries.—General: 7 admissions; no deaths. Local: 401 admissions; 2 deaths (1 from concussion of the brain and 1 injury to spine).

Poisons.—There was 1 admission (coal-gas).

Effects of Anti-typhoid Vaccine.—There were 11 admissions.

No Appreciable Disease.—There were 41 admissions.

Suicides.—1 cut throat and 1 from hanging.

Officers.—Average strength, 36. Admissions, 113, equal to ratio of 358 per thousand; 17 deaths, equal to 53·79 per thousand. The chief cause of admission was influenza. There was 1 death from cerebro-spinal meningitis at Trentham. Deaths from influenza, 15. There was 1 death from poison (morphia, accidental; officer on leave).

General Remarks.

Had it not been for the outbreak of pneumonic influenza in November the health returns for the camps would have been as good as the previous year, and, indeed, as regards mortality, would have shown a marked improvement.

The pneumonic influenza which supervened in so aggravated a form on the milder form of influenza was no doubt helped on by the importation of a severer form from Africa and Europe.

No new bacilli have so far been definitely identified, and those discovered in the present epidemic are all of the same character as those we have had previous experience of. They seem to have increased in virulence and infectivity as the result of the disease having broken out amongst large bodies of troops whose resisting-power had become weakened as the result of the privations of war, and in New Zealand by the very severe weather conditions which prevailed at the time.

Spraying, avoidance of overcrowding, stimulation and rest, with scrupulous cleanliness of camps, were the methods found most successful in combating the disease, along with most careful nursing. As Colonel Leahy remarks, care has to be taken in spraying that the patients remain only three minutes in the vapour, which should be quietly inhaled, that the apartment be not overcrowded, and that the vapour should contain a 1-per-cent. solution of sulphate of zinc and no stronger.

That these steps were more or less successful may be gathered from the large number of pneumonia cases that recovered, and that in both Trentham and Featherston half the men in camp did not contract the disease at all.

R. S. F. Henderson, Surgeon-General,
Director-General of Medical Services.

REPORT OF ASSISTANT DIRECTOR OF MEDICAL SERVICES (SANITARY) ON SANITATION OF THE MILITARY CAMPS FOR 1918.

The Director-General of Medical Services.

I have the honour to present the following report on the sanitary condition of the camps in the year 1918.

The year has been a disastrous one owing to the outbreak of pneumonic influenza in November, whereby 4,740 cases were affected, with 287 deaths. Prior to this a widespread epidemic of

influenza of lighter type had been present in the camps, but, save for an increase in cases of cerebro-spinal meningitis consequent on the prevalence of catarrhal conditions, the statistics up till November were very satisfactory.

Appended are reports by the Principal Medical Officers setting out the general sanitary measures taken throughout the year. These measures differed little from those which proved so successful the previous year. We had further evidence as to the value of the segregation of recruits, the routine examination of throats, and the treatment by isolation and by inhalation of all suspicious conditions. The failure of these measures to avert the epidemic of influenza is dealt with in the reports of the Principal Medical Officers and in my special report on the outbreak.

STATISTICAL.

Death-rate.

Owing to the Armistice and the consequent evacuation of the camps in November the records for the year are incomplete, and little value can be gained by attempting to work out a death-rate.

In all 312 deaths have occurred, of which 287 can be attributed to the influenza outburst, and but for this misfortune the number of deaths would probably have been lower than in any previous year. The following table shows the number of deaths in the Expeditionary Force during the last four years and a half :—

Year.	Deaths.
1914 (4½ months)	6
1915	61
1916	104
1917	46
1918	312
Total	529

The deaths in 1918 were distributed through the camps thus :—

Trentham	97
Featherston	187
Narrow Neck	17
Awapuni	8
Hanmer	3
Total	312

The influence of the outburst of pneumonic influenza is shown in this way :—

	Prior to Epidemic.	During Epidemic.
Trentham	7	90
Featherston	10	177
Narrow Neck	...	17
Awapuni	1	7
Hanmer	...	3
Totals	18	294

The following table gives the general causes of death, showing the years 1917 and 1918 for comparison. The influence of the influenza epidemic in 1918 has resulted in ten times the number of deaths from disease occurring in 1917, but deaths from accident and suicide were very low :—

Camp.	Disease.		Accident.		Suicide.		Total Deaths.	
	1917.	1918.	1917.	1918.	1917.	1918.	1917.	1918.
Trentham	10	95	2	1	1	1	13	97
Featherston	18	184	5	2	7	1	30	187
Awapuni	1	8	..	..	..	..	1	8
Narrow Neck	1	17	..	..	..	..	1	17
Rotorua	1	..	..	..	..	..	1	..
Hanmer	..	3	..	..	..	..	..	3
Totals	31	307	7	3	8	2	46	312

Of the 312 deaths 28 were in civil hospitals, 280 in camps, and 4 not in hospital.

Causes of Death.

The attached table shows the causes of deaths in each of the four camps. Included under deaths from influenza infection are some cases in which the direct cause of death was meningococcal infection following directly on the epidemic of November. They may reasonably be regarded as forming part of this epidemic.

Cause.	In Camp.	Out of Camp.	Total.
FEATHERSTON CAMP.			
Influenza infection	165	8	173
Cerebro-spinal meningitis ..	4	2	6
Asthma	..	1	1
Tubercle of lung	..	1	1
Pneumonia	1	..	1
Diabetes	..	1	1
Suicide	1	..	1
Accidental death	1	1	2
Alcoholic poisoning	..	1	1
Totals	172	15	187
TRENTHAM CAMP.			
Influenza infection	73	14	87
Cerebro-spinal meningitis ..	2	..	2
Valvular disease of heart ..	2	..	2
Apoplexy	3	..	3
Carcinoma	1	..	1
Accidental death	1	..	1
Suicide	1	..	1
Totals	83	14	97
AWAPUNI CAMP.			
Influenza infection	5	2	7
Tubercle of lung	..	1	1
Totals	5	3	8
NARROW NECK CAMP.			
Influenza infection	14	3	17

NOTE.—In Featherston Camp 4 deaths from cerebro-spinal meningitis are included in the 165 deaths from influenza infection; in Trentham Camp 5 deaths from cerebro-spinal meningitis are included in the 73 deaths from influenza infection.

It will be seen that there were only 2 deaths by suicide, as compared with 8 in 1917, 3 in 1916, and 4 in 1915.

Sickness.

Owing to difference in classification of the returns, comparative figures for the incidence rate of illness in the four camps are not accurate. For the first two quarters of the year the admission-rate to hospital at Featherston was below that of 1917. In the third quarter it rose from 4·2 per thousand average strength to 14·4 per thousand. This was due to the first wave of influenza. In the fourth quarter it rose to 58·4 per thousand, a result of the second wave.

At Trentham the rate was slightly higher throughout the first two quarters than in 1917. In the third quarter it rose to 36·5 per thousand, due to a very widespread first wave of influenza. In the fourth quarter it rose to 70·5 per thousand, due to the November second wave of influenza.

At Awapuni and Narrow Neck the sickness-rate in the last two quarters is similarly increased.

Infectious Disease.

In the following table is shown the incidence of various forms of infectious disease among men attached to the four camps in 1918 as compared with 1917 :—

Disease.	Featherston.		Trentham.		Awapuni.		Narrow Neck.		Totals.	
	1917.	1918.	1917.	1918.	1917.	1918.	1917.	1918.	1917.	1918.
Cerebro-spinal meningitis	10	44	3	11	..	..	..	..	13	55
Measles	28	140	26	118	..	..	..	..	54	258
Diphtheria	11	9	8	3	2	..	..	..	21	12
Enteric fever	1	1	1	..	..	..	1	..	3	1
Scarlet fever	2	6	2	1	..	..	..	..	4	7
Chicken-pox	2	4	3	1	..	..	..	..	5	5
Erysipelas	1	2	1	2	..	..	..	..	2	4
Simple pneumonia ..	7	6	4	3	2	5	1	..	14	14
Broncho-pneumonia ..	..	320	..	203	..	27	..	..	..	550
Influenza	..	4,202	..	3,024	..	226	..	432	..	7,884
Totals	62	4,734	48	3,366	4	258	2	432	116	8,790

It will be seen that the camps in 1918 did not enjoy the same immunity from infection which they did in 1917. The chief exception is as regards diphtheria, which was reduced from 21 in 1917 to 12 in 1918. Of these 12, 8 were among men while absent on leave. This result is somewhat striking when we remember that a very widespread epidemic of diphtheria affected the civil population throughout the year. This freedom must be attributed to the use of the inhalation chamber and careful segregation of suspicious throats among recruits and men returning from leave.

Simple Pneumonia shows a total of 14 cases, the same as 1917. One death occurred in a post-influenzal case prior to the severe epidemic of November.

Cerebro-spinal Fever.

Incidence.—The effect of the widespread influenzal epidemic, beginning in July and culminating in November, is reflected in the increased incidence of cerebro-spinal fever. In all 55 cases occurred, as compared with 13 in 1917. Of these 55, 7 followed directly on an influenzal attack during the earlier epidemic, and 24 during the severe type of the disease in November and December. Thus in all 31 were post-influenzal cases, and of these 11 died. Of the 24 cases not a direct sequel of an influenza attack, it is probable that they were the outcome of the general prevalence of catarrhal disease in the camps produced by influenza, since it is known that the meningococcus tends to become virulent as a result of aggregation of such catarrhal cases.

The following table shows the incidence of meningococcal infection in Featherston and Trentham. No cases occurred in Awapuni or in Narrow Neck Camps:—

Month.	Featherston.			Trentham.		
	Cerebro-spinal Meningitis.	Influenza.	Measles.	Cerebro-spinal Meningitis.	Influenza.	Measles.
January	..	8	40	..	23	17
February	..	13	19	..	20	35
March	..	10	11	..	13	17
April	..	3	3	1	14	..
May	..	14	..	..	26	..
June	..	8	..	..	18	..
July	4	99	2	..	78	1
August	11	403	10	1	103	13
September	1	326	14	1	877	14
October	8	458	23	2	484	14
November	19	3,174	18	6	1,566	7
December	1	6	..	..	5	..
Totals	44	4,522	140	11	3,227	118

It will be seen that, as in the year 1917, Featherston suffered much more severely than did Trentham. This is partly because there were an average of 5,674 troops in Featherston as against 2,744 in Trentham. But as the incidence in Featherston was four times that of Trentham we must conclude that, as before, the chief source of the disease was the presence at Featherston of new recruits in their early weeks of training.

The above table shows very markedly the influence which was exercised by influenza, since but for a sporadic case in Trentham in April no case occurred till July, when the first wave of influenza was established at Featherston, and here cases accompanied the course of this wave throughout August, September, and October.

In Trentham the epidemic did not begin till August, and in this month also a cerebro-spinal meningitis case was reported.

The secondary influenza wave of severe type which swept the camps in November produced as a sequel a very marked increase in cerebro-spinal meningitis infection at Featherston, as 19 cases occurred there during that month; and in Trentham, which had hitherto been very free of meningococcal disease, 6 cases arose, all in convalescents from influenza attacks. At Featherston the reports indicate that after the use of anti-meningococcal vaccine on the convalescents from influenza the cerebro-spinal meningitis cases ceased.

Pneumonia of the type seen in 1916 associated with meningococcal infection does not appear to have been prevalent. Captain Crawshaw mentions pneumonic symptoms in three of his cases, and in two there was a fatal result. But in these the meningeal symptoms appear to have also occurred, and it seems probable that these were cases of double infection. In 1916 the post-measles pneumonia was not generally accompanied by evidence of cerebro-spinal infection, though there was good reason to believe that the meningococcus was the cause of the pulmonary condition. There is little evidence of the occurrence of the meningococcal pulmonitis during the November epidemic, though the clinical symptoms of many of the post-influenzal broncho-pneumonias were not unlike the post-measles pulmonitis cases of 1916. The age-incidence, however, differs greatly, since the meningococcal lung-infections were mostly among youths of 20 to 22, whereas the influenzal pneumonias of November, 1918, were largely among older men. There is then little evidence of meningococcal lung-infections following on the recent influenzal attacks. Of the total of 55 cases, 12 occurred among men absent from camp on leave, 2 of whom died. In one of these cases it was obvious that infection was not received in camp. In the other 11 the matter

was doubtful, since meningococcal infection was very prevalent among civilians in 1918, especially in Wellington Province.

Mortality.—Among the 55 cases in 1918 there were 17 deaths, giving a case mortality of 31 per cent. This compares favourably with previous years, in which the mortality has been 61 per cent. The following table gives the case mortality in the two camps and in previous years:—

Year.	Trentham.			Featherston.			Total Mortality.
	Case Mortality.	Cases.	Deaths.	Case Mortality.	Cases.	Deaths.	
	Per Cent.			Per Cent.			Per Cent.
1916	60·0	35	21	62·5	24	15	61
1917	33·3	3	1	70·0	10	7	61
1918	63·6	11	7	22·7	44	10	31

It will be seen that the mortality at Featherston for the year was only 22·7 per cent., which is the lowest recorded. This satisfactory result must be attributed in great measure to the methods of treatment adopted at that camp, as recorded in the report of Captain Crawshaw. The use of intravenous and intrathecal serum injections appears to have been successful, even in very acute cases. Among the 36 military cases treated at Featherston the death-rate was only 22·2 per cent. The death-rate of 22·7 per cent. given in the foregoing table includes cases occurring outside the camp and therefore treated elsewhere.

Influence of Age in Incidence and Mortality.—In the following table is shown the distribution of cases of cerebro-spinal meningitis and deaths according to age-groups:—

——	Under 20.	20 to 24.	25 to 29.	30 to 34.	35 to 39.	40 and over.	Total.
		20, 21, 22, 23, 24.					
Cases	1	15, 5, 2, 1, 0	9	13	6	3	55
		23					
Deaths	..	5	..	6	4	2	17
Case mortality (per cent.)	..	17·4	..	46·1	66·6	66·2	30·9

It will be seen that 24 of the 55 cases were men under 25 years of age, a proportion of 43 per cent. Five of those 24 died, a case mortality of 20·8 per cent.

Of the 31 cases of 25 years and over 14 died, a case mortality of 38·7 per cent. This differs somewhat from previous years, in which the younger men did not escape so lightly. This seems to have been the result of the influenza epidemic affecting the more mature men more severely.

Variation in Incidence and Mortality due to Influenza.—Of the total of 55 cases, 25 occurred as a sequel to the severe influenza epidemic of November. Of these cases 9 died, a case mortality of 36 per cent. Of the 30 cases prior to this epidemic 8 died, a case mortality of 27 per cent. Thus the severity of the influenza infection was reflected on the severity of the meningococcal complication. The age-incidence among the 25 post-influenzal cases differs somewhat from the general age-incidence, as 9 were under 25 years—that is, 36 per cent. Of the 30 cases occurring prior to the epidemic 15 were under 25 years—that is, 50 per cent. The proportion of men under 25 years who were affected by influenza during the epidemic was 42 per cent., so that the meningococcal complication did not affect the men under 25 years in the ratio which might have been expected, considering the known greater susceptibility of the young to cerebro-spinal fever.

The mortality, too, shows a marked reduction among the younger men who suffered from post-epidemic meningitis, for of the 9 cases below 25 years only 1 died—that is, 11 per cent. —whereas of the 16 cases of 25 years and over 9 died, a case death-rate of 56 per cent.

This variation as to relationship of age to incidence and mortality of cerebro-spinal fever is not confined to the cases following the severe epidemic, for of the 8 post-influenzal cases which occurred earlier in the primary influenzal wave only 2 were under 24 years, and the 2 fatal cases were in men of 32 and 45 years of age.

Distribution.—The unit from which the men came has had little influence in the distribution of cases this year. In only one unit (D Company, 46th Reinforcements, at Featherston) were there 3 cases, even during the secondary wave of influenza.

Influence of Occupation.—Forty per cent. of the patients were employed in civil life in outdoor work up country. This is a lower proportion than in former years, in which about 75 per cent were either farmers or occupied in similar work. This is due to the inclusion of post-epidemic influenza cases, among whom only 36 per cent. were from outdoor employments. The incidence of the influenza epidemic was so widespread as to affect all persons alike. Possibly also the proportion of men from the towns was higher in the later Second Division drafts.

Influence of Locality.—As in former years, the district from which the men came exercises an influence in the spread of cerebro-spinal fever. During 1918 Wellington Province was the one most affected, although in previous years the men from this district largely escaped. Eighteen

of the total (or 33 per cent.) came from Wellington Province, and 15 from Auckland. The other districts contributed evenly. It is of some interest to find in this connection that during 1918, among civil cases notified to the Public Health Department, by far the larger number also came from Wellington Province. This seems to have been in a measure due to the primary wave of influenza which affected severely certain districts in this province. It is probable also that some cases were due to the presence of the camps, as in two cases at least the outbreak could be traced to men on leave. At a Cadet Camp in Palmerston North also some cases of cerebro-spinal fever following influenza arose. The social intercourse of the men rather than their military work affords the chief opportunity for the spread of infection.

The following shows the cerebro-spinal meningitis cases among men attached to Featherston and Trentham Camps according to place of enlistment:—

	Cases.
Wellington district	18
(Wellington City, 7 cases.)	
Auckland district	15
(Auckland City, 11 cases.)	
Invercargill district	4
(Invercargill City, 3 cases.)	
Christchurch district	5
(Christchurch City, 3 cases.)	
New Plymouth district	6
Dunedin district	3
(Dunedin City, 2 cases.)	
Hawke's Bay district	3
Blenheim district	1
Total	55

The following tables summarizing observations on cerebro-spinal fever in camps for the last three years are of interest:—

Summary of Observations on Cerebro-spinal Fever in Camps for Years 1916, 1917, and 1918.

Case Incidence and Mortality.—Total cases, 127; deaths, 61; case mortality, 48 per cent.

AGE-INCIDENCE AND MORTALITY.

—	Under 20.	20 to 24.	25 to 29.	30 to 34.	35 to 39.	40 and upwards.
		20, 21, 22, 23, 24.				
Cases	2	40, 13, 5, 4, 3 = 65	23	20	11	6
Deaths	1	29	9	12	6	4
Case mortality (per cent.)	50·0	44·6	39·1	60·0	54·5	66·6

Influence of Occupation in 106 Cases:—	Indoor.	Outdoor.
Cases	40	66
Deaths	13	37
Case mortality (per cent.)	32·5	56

R. H. MAKGILL, Lieut.-Colonel, A.D.M.S.(S.).

REPORT OF ASSISTANT DIRECTOR OF MEDICAL SERVICES (SANITARY) ON INFLUENZA IN MILITARY CAMPS IN NEW ZEALAND, 1918.

In common with the rest of the world the military camps in New Zealand in the year 1918 suffered very severely from influenza, which showed itself in two different waves—an earlier one of a comparatively mild type with its maximum intensity about September, and a later one of very high virulence in the first weeks of November, which occasioned 287 deaths.

HISTORY.

Influenza each year hitherto has played a more or less important part in the sickness returns of the camps.

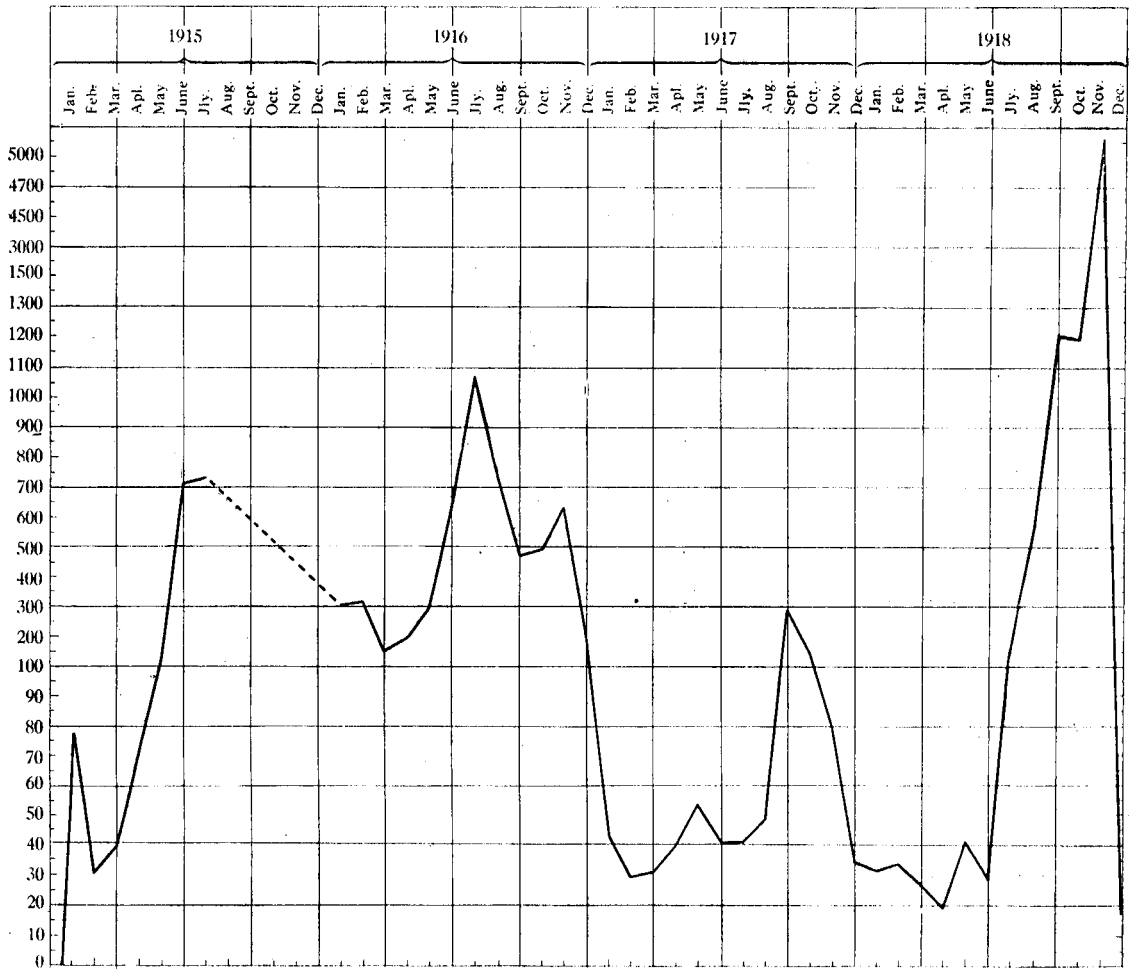
In 1915 it was fairly prevalent in winter, the total cases up to the middle of July being 1,814. The crest of the epidemic was in July. Returns for the year are not complete. Several deaths from pneumonia and cerebro-spinal meningitis were attributed to this disease.

In 1916 there were 5,527 cases of influenza admitted to the various military hospitals from the camps, the apex of the epidemic wave being in July. With this epidemic 91 cases of pneumonia occurred, with 39 deaths, but in 50 of these cases measles was the preliminary disease. However, 4 cases of pneumonia and 9 cases of cerebro-spinal meningitis were directly attributable to influenza, and it is probable that, in 41 cases of pneumonia not preceded by measles, influenza played an important part. Of the 41, 4 cases were fatal, so that, with 5 fatal cases of post-influenzal meningitis, in all 9 deaths could be directly traced to influenza.

In 1917 there were 1,156 cases of influenza, fairly evenly distributed throughout the year, but with a distinct wave in early spring, the crest of which was reached in September. With this fall in influenza incidence there was also a reduction in pneumonia and cerebro-spinal meningitis, only 14 cases of the former being notified, with 1 death, and 13 of meningitis, with 8 deaths. Seven of these cases of cerebro-spinal meningitis occurred in connection with the slight influenzal outbreak in the spring.

The Epidemic of 1918.

In 1918 there have been 8,528 cases of influenza all told, with 287 deaths, 280 of which were from pneumonic complications and 9 from cerebro-spinal meningitis, a case mortality of 3·3 per cent. The accompanying chart shows the annual recrudescence of influenza in the camps.



NOTE.—The spacing above 100 is decreased. This exaggerates the minor waves below 100.

It will be noticed, on referring to the chart, that the waves of the epidemic have hitherto reached their crests in the winter months—July to September—and this is in accordance with experience in Britain. In 1918, however, there were two distinct waves, one reaching its maximum crest in September with fairly gradual rise, while the other arose very suddenly in the latter days of October and spread with remarkable rapidity, reached its crest at the end of the first week in November, and then declined almost as suddenly as it rose. The virulence of this second wave was very much greater than that of the first, since in the latter only 2 deaths occurred among 3,170 cases which were directly attributable to influenza, while there were 281 deaths among the 4,749 cases forming the second wave. The greater number of deaths was due to pneumonic complications, as is usual in influenza, and the remainder were from cerebro-spinal fever, another complication arising where catarrhal diseases are massed together.

Primary Wave.—The primary wave of the epidemic in the camps was not accompanied to any marked extent by pneumonic complications, as only 13 of such cases (5 at Featherston, 2 at Trentham, and 6 at Narrow Neck) occurred between July, when the first wave began, and the 28th October, when the second wave started. Only 1 of these died. There were also some severe influenzal attacks in October with slight lung symptoms, but not definitely pneumonic. It seems possible that the elaborate system of segregation of recruits and inhalation treatment adopted in the camps sufficed to keep these pulmonary complications in check so long as they were of the lower degree of virulence.

As regards cerebro-spinal fever the influence of the first wave is more marked. In the first week of July these cases began to appear in Featherston coincident with the rise of influenza. Later a few cases also arose in Trentham, and by the end of October 31 cases had occurred, with 7 deaths in the two camps or in persons associated with the camps. In 7 of these cases the patient previously suffered from a definite influenzal attack, but only 1 of the 7 died. In the remaining cases it is reasonable to assume from our knowledge of cerebro-spinal fever that it was the outcome of the epidemic of influenzal catarrh. This supposition receives support from the fact that carriers of the meningococcus became much more frequent in incoming recruit drafts in the months of August and September. Apart from the Expeditionary Force camps an outbreak of cerebro-spinal

meningitis occurred in the Cadet Camp at Palmerston North in August, preceded by an epidemic of influenza.

The Second Wave.—The second wave manifested itself first among the Native troops in Narrow Neck Camp about the 28th October, and almost simultaneously at Awapuni. At Featherston the first case appeared on the 29th October, but the wave did not begin to show a marked increase till the 6th November. At Trentham, while there had been a suspicious case as early as the 16th October, there is some evidence that the earliest cases of the second wave were men who arrived from Awapuni on the 2nd November, and had to go straight to hospital. The wave increase began on the 4th November. In all the camps it was of the briefest duration, being over in about fourteen to sixteen days, by which time doubtless the majority of those susceptible had been infected. The cerebro-spinal cases developed among convalescents who had been some days normal.

Course of Spread of Second Wave.—Since the spread of the secondary wave among the civil population appears to have come from Auckland, it is of interest to examine in detail the history of the appearance of the disease in the different military camps, as these furnish the only reliable evidence we possess in the absence of general notification.

Narrow Neck Camp.—This appears to have been the first of our military institutions to show the secondary wave in full virulence. This camp was specially for the training of Native troops who came from Rarotonga, Gilbert Islands, and New Zealand Natives. These people are specially susceptible to catarrhal and pneumonic infections. It is somewhat surprising, therefore, to note that up to October they were free from influenza. On the 7th October, however, there was a sudden sharp outburst of the disease with 130 cases, and in two days 226 cases had been infected. Of these 13 were severe, and several showed slight pneumonic symptoms. On the 9th October the Director-General of Medical Services ordered the camp to be broken up and the men scattered to various canvas camps. By the 11th October the epidemic was over, as on that day only 1 case was reported. Among such virgin soil for the growth of the organism as these susceptible Natives from outlying parts the rapid spread is not surprising. But there were no deaths. For the next fortnight there were practically no new cases reported, but about the 24th October cases began to arise again, and on the 28th October the second wave of infection became evident with 9 admissions. This wave rapidly reached its crest on the 31st October, when 42 cases were admitted to hospital, all of a more severe type than in the previous wave. In all 130 cases received hospital treatment. Pneumonic cases were reported early in the outburst, and 14 cases died from this cause before the epidemic ended, which it did about the 18th November, when the camp was again broken up.

It seems certain that many who had recovered from the first epidemic must have been infected in the second outburst, suggesting that among such susceptible persons the degree of immunity conferred was low. The death-rate was 5·3 per cent., which is high, as one would expect when dealing with Native troops. The sudden explosive character of both these outbursts is remarkable, as also the close proximity between the first and second waves of infection and the total cessation of cases in this interim period.

North Head Fort Garrison.—It is of interest to compare the epidemic as it affected the neighbouring garrison troops at Devonport. Here also the two waves appeared in October. The record is as follows:—

	Cases.	Severe Cases.	Deaths.
October—			
First week	...	...	...
Second week	23	14	...
Third week	10	4 (2 Natives)	...
Fourth week	5	2	...
Last three days of month	9	6	...
November—			
First week	30	25 (11 Natives)	6 (4 Natives)
Second week	14	11 (2 Natives)	2
Third week	7	5	1
Remainder of month	...	...	...

The reference to Natives in this table indicates those who were in detention in the fort. The two Natives who got ill in the third week in October (16th) were pneumonic in type, but recovered.

The crest of the primary wave was on the 7th October, and then came a period of comparative freedom for two weeks, exactly as in Narrow Neck Camp.

The second wave began also on the 29th October, and reached its crest of intensity on the 7th November with 7 cases, 4 of whom died later.

It is noticeable that in these two camps there was no gradual increase of the epidemic in the third and fourth weeks. The second wave began on the 28th October, and the crest was reached in nine days, and was over in eighteen days from the start.

Awapuni.—The first wave appeared in August, and was not severe in type. In September and the first three and a half weeks of October the incidence was low. But there was a tendency to rise in the last three or four days of October, and on the 30th the first typical pneumonic case went into hospital. That this man should just have come into camp from Auckland two days before is significant. Others coming from Auckland on the 18th and 26th October did not develop influenza.

The cases increased rapidly in the first few days of November, and the crest of the wave was reached on the 6th November, and subsided rapidly, ending on the 14th November. It is practically coincident with the second wave in the Auckland camps. There were 154 cases out of a total camp strength of 317 at Awapuni—about 50 per cent. of the population—and 5 deaths occurred, all from pneumonic complications, giving a case mortality of about 3·2 per cent.

Featherston Camp.—In Featherston Camp the first wave was in August (403 cases), then followed a slight drop in September (326 cases), with a rise again in October (458 cases), but towards the end of October the spread appeared to lessen till the arrival on the 24th and 25th October of a C1 draft. Of this draft 126 men came from Auckland, and among these on the 26th 10 cases of influenza were reported, though not of a specially severe type at the time, and for the first week after their arrival there was no general epidemic among these men.

The table following shows the daily incidence of influenza according to unit at the end of October and the beginning of November :—

Unit.	October.						November.				Total.
	26th.	27th.	28th.	29th.	30th.	31st.	1st.	2nd.	3rd.	4th.	
46th	1	1	2	2	1	2	4	6	14	20	53
47th	2	..	..	1	3	1	1	4	13	37	62
48th	..	1	..	..	..	..	..	2	..	3	6
N.Z. Field Artillery ..	1	..	..	1	3	2	12	8	5	7	39
N.Z. Mounted Rifles ..	2	..	..	..	1	..	2	2	1	3	11
Specialists	1	..	1	..	..	..	2	3	3	16	26
C1	10	3	7	5	5	5	13	18	25	38	129
N.Z. Medical Corps ..	..	..	..	..	..	..	5	8	4	10	27
Home Service ..	..	..	..	..	..	..	1	2	1	3	7
Daily total ..	17	5	10	9	13	10	40	53	66	137	360

NOTE.—C1 men mobilized on the 23rd, 24th, and 25th October.

This indicates clearly that the C1 draft suffered most heavily at this time, and further evidence is found that this was the source of the severe infection in the fact that on the 29th October the first of the pneumonic cases occurred in this draft, the patient being a man who arrived from Auckland in camp on the 24th October. Since the incubation period is about forty-eight hours it is evident that this man did not himself contract the infection in Auckland or on the journey down, but probably was infected from the earlier cases developing after arrival in camp.

Again we find that, amongst the first 219 cases of the severe wave, 39 per cent. came from Auckland Province. A large number of troops, including many from Auckland, had returned from leave on the 23rd October, yet their return did not result in any special wave of infection, suggesting that the epidemic in Auckland at the time of their departure (23rd October) was not yet severe.

It must be noted that in the crowded troop-trains there is every facility for the rapid transference of disease throughout the troops, and experience with measles and cerebro-spinal meningitis has shown that troop-trains are fertile sources of infection. The absence of severe infection in these units on the 23rd October is therefore significant. This also applies to the C1 draft arriving on the 24th and 25th October, who did not show any special spread at first, although 127 had made the long journey from Auckland in such close contact that had the disease been as infective as it became a week later they must have shown perhaps 50 per cent. of infection within a day or so of arrival in camp.

The above table shows that on the 1st, 2nd, and 3rd November the epidemic was slowly gathering force, but the 4th November is given by the Principal Medical Officer as the date when the secondary wave was definitely established. This coincides with the return of the men from week-end leave, and doubtless the train journey had much to do with the dissemination of infection from the earlier cases. The spread from then onwards was extraordinarily rapid, and the wave reached its maximum intensity on the 7th November, on which day over 400 new cases were reported. Thereafter there was a steady decline in the incidence, and the epidemic was over on the 20th November, as shown in the following table, only two or three cases per day being thereafter reported :—

Date.	Cases.	Date.	Cases.
October 28	12	November 10	257
29	10	11	274
30	14	12	149
31	10	13	95
	—	14	99
Total	46	15	104
	—	16	49
November 1	38	17	44
2	48	18	41
3	69	19	30
4	149	20	22
5	149	21	12
6	395	22	8
7	418		—
8	371	Total	3,165
9	344		

TOTALS.

	Cases.
28th October to 31st October	46
1st November to 22nd November	3,165
	3,211
23rd November to end of month	9
	3,220

By a most unfortunate coincidence the crest of the epidemic wave was synchronous with a spell of exceptionally wet, stormy weather, culminating on the 7th November with a gale which wrecked many buildings and tents, greatly adding to the difficulties of the Staff. One of the most serious results was the temporary crowding of cases that inevitably followed, and doubtless this, with the cold and wet, favoured the development of pneumonic complications.

In all 3,220 cases were treated in hospitals and temporary hospitals, but a large number of other cases occurred, estimated by the Principal Medical Officer as bringing the total to 3,339, or nearly half of the population of the camp, which was 7,800 at that time. Of these 314, or slightly under 10 per cent., showed pneumonic complications, and of these 161 died, a case mortality of roughly 50 per cent.

During the decline of the epidemic wave 19 cases of cerebro-spinal fever appeared among the convalescents, and of these 5 died, making a total death-rate of 166 from the results of influenza, or about 5 per cent. of those infected.

Trentham Camp.—In Trentham the first wave was somewhat later than in the other camps, coming in September with 877 cases, but without any pneumonic complications and only 2 cases of cerebro-spinal meningitis. There was a marked drop in October to 484 cases, but with these there were 4 cases of exceptional severity, 2 of which were definitely pneumonic, but recovered. One was admitted to hospital on the 16th October—a man who came from Auckland on the 9th October; the other 3 were admitted on the 23rd October. There was also 1 case of post-influenzal cerebro-spinal fever on the 24th October, who also recovered.

The following table shows the admissions for influenza at the end of October and beginning of November:—

Date.	Cases
October 28	3
29	7
30	7
31	2
November 1	5
2	7
3	4
4 (beginning of wave)	29
5	61
6	137
7	102
8	150
9	221
10 (crest)	194
11	209
12	135
13	94
14	62
15	50
16	37
17	19
18 (wave ends)	17

The absence of any epidemic till the 4th November is clearly shown. The report of the Principal Medical Officer, however, indicates that the first of the severe cases were among seven men admitted on the 1st and 2nd November. Three of the latter were members of the N.Z.M.C., who arrived ill on the 2nd November from Awapuni and went at once into hospital. This seems to indicate the source of infection of the severe type, as we know that by that date the secondary wave had begun to develop in Awapuni Camp. Thus the history of the second wave in Trentham seems again to point to Auckland as the place from which the epidemic spread. As at Featherston, the men returning from week-end leave showed a high proportion of infection on the 4th November. That there was no general infection in Trentham before the 4th November is shown by the fact that the 49th Reinforcements were transferred to Featherston on the 1st November, but on arrival there showed no infection till they had been four or five days in camp. It is noticeable that the 4th November was also the date on which the wave appeared in Featherston. Probably the contact in the week-end leave troop-trains accounts for this coincidence. The wave developed somewhat more slowly than in Featherston, as the 10th November was the date on which the crest was reached, but it declined more rapidly, and was over in a fortnight from its commencement. In all some 1,566 cases occurred in Trentham Camp during the second wave, 203 of which developed pneumonic symptoms. Of these 67 died, a case of mortality of 34 per cent. In addition 5 cases of cerebro-spinal fever occurred among the convalescent from this influenzal outburst, all of whom died. Thus the total deaths from the secondary epidemic wave were 73, giving a general

case mortality of 4·6 per cent. This lower death-rate, the delayed crest of intensity, and the rapid disappearance of the epidemic suggest that a certain degree of immunity had been conferred by the high primary wave of infection in September.

General Characteristics of the Epidemic.

The clinical features of the disease have been reported on by the Principal Medical Officers of the different camps, so I shall confine myself to the epidemiological features. It may be said, however, that the symptoms and complications generally coincide with those found in the reports of observers in Britain and America and elsewhere. They closely resemble also the clinical type of disease which produced so disastrous an epidemic on the transport "Tahiti" at the end of September. Save in the degree of fatality the same symptoms were seen in many cases arising in civil life in New Zealand in September and October, and in a few cases in the camps in those months.

The following table shows the general incidence of influenza in camps and the larger military hospitals throughout the year 1918, being compiled from the hospital admission returns:—

Month.	Featherston.	Trentham.	Narrow Neck.	Awapuni.	Rotorua.	Hanmer.
January	8	23	..	1	..	..
February	13	20	..	..	..	..
March	10	13	..	3	..	..
April	3	14	..	1	..	..
May	14	26	..	2	..	..
June	8	13	..	..	..	..
July	99	78	..	8	..	..
August	403	103	..	54	..	..
September	326	877	..	10	..	..
October	408	484	226	27	..	8
November	3,174	1,566	206	147	151	29
December	6	5	..	..	..	6
Totals	4,522	3,227	432	253	151	43

Age Incidence.

	Under 20.	20 to 24.					25 to 29.	30 to 34.	35 to 39.	40 and upwards.
		20,	21,	22,	23,	24.				
214 cases influenza of primary wave—24th October to 3rd November.										
Cases	3	52	13	9	0	8	42	44	40	4
				82						
Percentage ..	1·4	24·3	6·0	4·2	..	3·7	19·6	20·5	18·6	1·4
				38·3						
2,248 cases influenza of secondary wave—4th November onward.										
Cases	80	545	148	79	39	56	436	483	292	90
				867						
Percentage ..	3·5	24·3	6·6	3·5	1·7	2·5	19·0	21·5	13·0	4·0
				38·5						
237 cases broncho-pneumonia (out of a total of 301 cases).										
Cases	4	30	19	10	5	13	53	67	27	10
				77						
Percentage ..	1·6	12·6	8·0	4·2	2·1	5·4	22·3	28·2	11·3	4·2
				32·5						
161 deaths from influenza-pneumonia.										
Cases	1	22	6	4	3	9	41	43	22	10
				44						
Percentage ..	0·6	13·6	3·7	2·4	1·2	5·5	24·8	26·7	13·6	6·2
				27·3						

The above table is compiled from influenzal infection occurring in Featherston Camp. Owing to the heavy incidence in the camp and the depletion of the staff by the disease it was not possible to keep accurate records of all cases, but reports indicated that the average age at least of the serious cases was 29 years. The Principal Medical Officer, Featherston, remarks that the age incidence was chiefly between 25 and 40, and those over 50 were comparatively immune. This seems to be the general experience.

The younger soldier suffered in common with the others, but the incidence of broncho-pneumonia and the mortality among these was less. The table seems to show a heavy incidence among men aged 20 years, but this is probably due to the age distribution in camp. At this period a number of men just attaining military age were in training; the men of 20 and upward had already gone.

During the epidemic in the camps of pneumonia following measles and influenza, 1915–16, the incidence fell chiefly on the younger men between 19 and 23. That epidemic was probably meningococcal in origin. The incidence among men of more mature years suggests that the meningococcus did not play a great part in the epidemic of 1918.

Incubation Period.

All the evidence from the camps points to a very short incubation period, possibly under twenty-four hours in susceptible cases, probably not longer than forty-eight hours.

Period of Infectivity.

No very reliable data on this point have been acquired. With so universal a distribution of infection as occurred in November the detailed histories of cases cannot be traced accurately. It is certain that the cases are very infective in their earlier stages, and probably this rapidly diminishes as convalescence approaches. I have not known any case of infection attacking the attendants in the civil convalescent hospitals, which would suggest that after the temperature has been normal for two or three days the infective period is over. In one case observed the sputum was clear of pneumonic or influenzal bacilli on the fifth day, despite a relapse on that date.

Bacteriological Considerations.

The influenza bacillus seems to have been constantly present in both waves, but in the second, among the earlier cases, it was less prominent, and in its place a diplococcus having some of the features of a pneumococcus was more prevalent. Later the influenza bacillus appears to have become again more noticeable. The diplococcus was also observed in the cases from the troopship "Tahiti." Major Ritchie, N.Z.M.C., reports that on investigation this proved to be a streptococcus.

It is significant that this streptococcus was first observed in 1917 in a severe outbreak in one of the American camps. They were also present among pneumonic cases arising as a sequel to a measles epidemic in Sling Camp among the 32nd Reinforcements. At present we do not know what part this diplococcus played in the epidemic. It seems possible that, though at first an associate of measles infection, this organism later found an opportunity for spreading in company with the more widely distributed influenzal bacillus, and took an ever-increasing part in the severity of the infection. Symbiosis of two organisms of this sort is a well-recognized factor in epidemiology. A similar relationship is now known to exist between the meningococcus and various catarrh-producing organisms, such as the influenza bacillus and the infective agent in measles, and in the New Zealand camps in 1915 and 1916 this produced epidemics of great severity. Any massing of catarrhal infections is followed by the appearance of complicating organisms, and the virulence of these rises as the opportunity for their spread increases, on the principle well known to bacteriologists that the rapid transference of an organism from victim to victim enhances its infectivity. In this connection attention may be drawn to the following table, which indicates the increase in infected throats arriving at the camps during the months when the first wave of influenza was prevalent:—

Month.	On Mobilization.		On Embarkation.	
	Diphtheria.	Cerebro-spinal Meningitis.	Diphtheria.	Cerebro-spinal Meningitis.
January	..	8	..	5
February	..	8	..	5
March	1	3	..	..
April	..	13	..	..
May	1	19	..	..
June	4	21	..	9
July	2	11	..	..
August	1	21	..	..
September	..	21	..	4
October	1	26	..	..
November	..	13	..	..
December	..	..	..	..
Totals	10	164	..	23

Influenza does not leave any great degree of immunity in the individual attacked, so that it is always certain of finding a sufficient number of susceptible individuals to enable it to become epidemic, given the general conditions—climatic and otherwise—necessary for its full development. A pandemic of influenza therefore provides a favourable opportunity for an organism associating itself with the influenza bacillus to attain a high degree of virulence. Doubtless this has been the case in the pandemic of 1918, and we shall presently learn what was this complicating organism attached in symbiosis with the influenzal virus. It is obvious on this hypothesis that where preliminary infection, be it measles or influenza, strikes a community of low resistance the epidemic is likely to assume serious characters.

It may be noted here that the reports of the Principal Medical Officers show that the disease was primarily an influenzal infection with potentialities for pneumonic or septicæmic complications in a large proportion of cases, and to a much lesser degree leading to meningococcal infection. Out of 4,740 cases in Featherston and Trentham in November 523 pneumonic cases arose —*i.e.*, in slightly over 11 per cent. of the cases. In no case has the pneumonic type been reported without the preliminary influenzal symptoms, so that the symbiosis of infecting agents seems to have been complete.

The complications arose in the cases independently of their admission to the hospitals. The conclusion, then, is that the complicating organisms were already of a sufficient degree of virulence to be able to invade without the rapid transference of infection and consequent heightening of potency which occurs when cases of acute infection are crowded. Where such crowding took place naturally the virulence would increase, but this was not essential to the development of pneumonic complications.

Protection following Attack.

The evidence as to the degree of immunity conferred by an attack of influenza of the first-wave type against the severe pneumonic form is indefinite. I have already suggested that in Trentham there was evidence of a partial immunity, but in the shifting population of a camp it is not safe to draw conclusions, for in two months a large part of the population may have changed. The Principal Medical Officer, Trentham, found that generally the cases who had suffered during the earlier wave of infection did not suffer in the second. He quotes one case in which a man discharged on the 31st October was readmitted on the 4th November with a second attack, but did not show any pneumonic symptoms; and similar cases are known in which the second attack seems to have been modified. I know of several cases in which one member of a family attacked in September or October remained immune in November, while others of the family who escaped the earlier infection suffered in the second. On the other hand it seems probable that the Narrow Neck troops showed little acquired immunity. The Commandant at Awapuni also reports that the first attack did not confer immunity from the second. At Featherston the Principal Medical Officer reports that those who suffered from four to six weeks before escaped lightly in the second epidemic. The records kept by the Sanitary Officer, Featherston, show that out of 301 cases of pneumonic infection in November 23 had suffered from a prior attack in August, September, or October, and of these 14 died. This high death-rate suggests that these were cases specially susceptible to infection, but the total number is not great. Had there been no conferred immunity one would have expected a higher proportion of severe second attacks, as there must have been many hundreds of soldiers in Featherston who had suffered in one or other camp during the previous months, and, judging by the general proportion of cases developing pneumonic complications, one might have expected at least 50 to 60 such cases amongst them. It is evident that a partial immunity is established for some weeks. The point is of importance, since by the existence or absence of such immunity one may judge as to the value of the use of a vaccine. The opinions of observers in other countries differ greatly, but on the whole it seems likely that if we knew the specific organism concerned a vaccine made therefrom would have a measure of success. The fact that there was a degree of immunity conferred by the first epidemic establishes also the bacteriological identity of the two outbreaks; they differed only in degree of virulence.

Value of Isolation.

No one who has studied the history of influenzal epidemics can doubt that complete isolation would absolutely protect a community. Many cases can be quoted, and in regard to military units the freedom from infection of the German internment camps in New Zealand can be cited. Theoretically it is possible, but in actual practice no means exist whereby we can secure perfect isolation if the country's work is to be carried on, since the disease is of so insidious a character that any developing a catarrh would have to be isolated as a possible harbinger of more serious infection. Sir Arthur Newsholme, President of the Local Government Board, London—an eminent authority on epidemiology—says he knows no measures which can resist the spread of a pandemic of influenza. (*Lancet*, 23rd November, 1918.)

Inhalation Chambers.

The experience in the camps since the systematic inhalation treatment of recruits and contacts was adopted has been emphatically in favour of this measure as a means of coping with all catarrhal infections of the naso-pharynx, especially measles. The absence of diphtheria in the camps during the past two years, despite the existence of widespread epidemic in the civil population, is significant, as also the fact that since its adoption measles has been kept in check, and such cases as arose have not been followed by serious complications.

A reference to the last table shows that the troops on embarkation are almost wholly free from suspicious throat-infections, a result in which the inhalation chamber plays a large part.

Since the systematic use of the inhalation chamber on troopships there has been a lessened incidence of severe infection. As an example of this the transport "Ruahine" may be quoted, which sailed on the 30th September with troops from Trentham Camp, where influenza was very prevalent. The whole of the troops were treated before embarkation, and daily for three days thereafter, and though a slight outbreak occurred on board it was checked quickly, and the troops arrived in London on the 5th December in good health. Considering the crowded conditions of life inseparable from a troopship this must be regarded as satisfactory.

On the other hand it must be admitted that the systematic use of the inhalation chambers failed in some measure to prevent the spread of influenza, even of the first-wave type in the camps, as, for example, the Trentham epidemic of September. The absence of serious complications in this epidemic—complications which we know were prevalent in the civil population at the time—may reasonably be considered to be in part due to this preventive measure. It totally failed, however, to check the spread of the second virulent wave, though we cannot, of course, say whether the severity was not modified thereby. There is some reason for thinking that such modification may have occurred from the fact that among those Headquarters department offices in which inhalation chambers had been installed at the beginning of July, and after September had been in constant use, very few serious cases of the pneumonic type were reported among the staff. It is obvious that, in a disease in which the invasion is so rapid as influenza of the later type, any measure for disinfecting the nose and throat must be applied very frequently. It seems certain that the organism can establish itself in under twelve hours, so that to be really effective the inhalation would require to be repeated shortly after any exposure to infection. The system adopted in many establishments of treatment before beginning work and again at the end of the day, it is reasonable to hope, should have some degree of success.

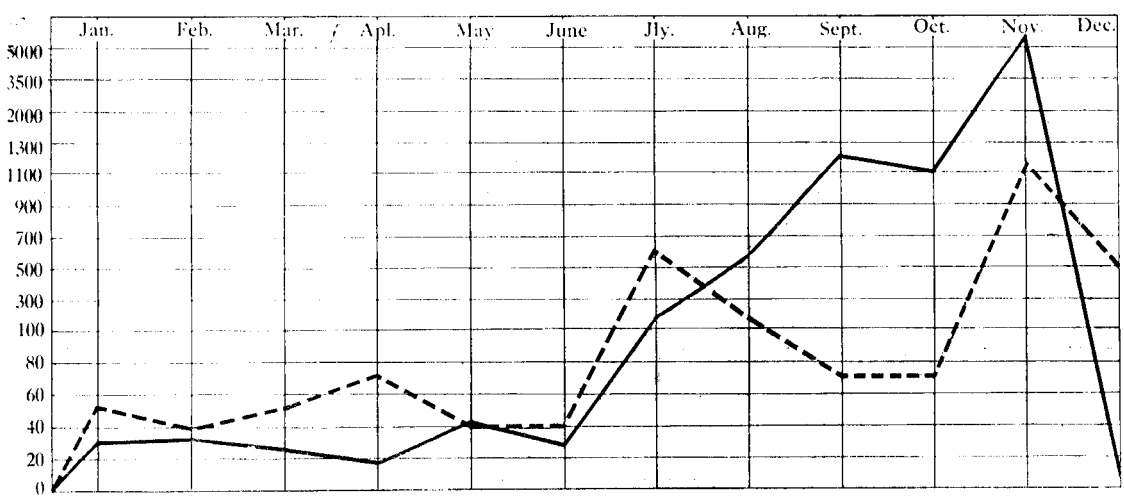
As illustrating the value of the inhalation chamber in modifying even the severe type of influenza I may quote from the report of Colonel Leahy, Principal Medical Officer, Trentham Camp. With such an epidemic as he had to combat, with a staff greatly depleted, only a limited investigation was possible. Eighty-six cases were observed; 53 had received spray treatment daily for three successive days. Of these, 12 developed a severe attack—that is, 22 per cent. Nineteen received only one or two treatments; of these, 8 became serious, or 42 per cent. Fourteen cases had received no treatment; of these, 7 became serious—that is, 50 per cent. The Principal Medical Officer, Featherston, also records a distinct lessening in pneumonia after the use of the inhalation chamber was made a daily matter. With evidence such as this we cannot afford to ignore the inhalation chamber as one of the measures to be adopted during an epidemic.

Spread of the Influenza Epidemic generally and in New Zealand.

It is apparent that influenza appeared in the New Zealand camps in two distinct waves differing greatly in severity, the first beginning in July and the second at the end of October, and that this latter was a very sudden and intense infection. It is also apparent that, while we have no evidence as to the origin of the first wave, the second wave was traceable to Auckland.

That this was so also in civil life is learnt from the reports of the District Health Officers, which show that the severe type showed itself in epidemic form in the main centres as follows: Auckland, 26th to 28th October; Wellington, 1st to 3rd November; Christchurch, 5th to 6th November; Dunedin, 12th to 14th November.

On the subjoined chart a broken line shows the deaths from influenza in London. Here also we see the two curves, the first with its crest in July, a month or so before the New Zealand primary wave. This interval between the London and New Zealand wave, one can understand,



Influenza infection in New Zealand camps—continuous line: ratio of deaths from influenza in London—broken line. (Note.—The spacing below 100 is modified to show the minor variations. The curves only show the relations between the various waves, and are not intended to represent actual figures.)

indicates the delay while infection was being carried to the Antipodes. When we turn to the second wave we find it is equally an explosive one of great intensity, but there is the remarkable fact that the two waves in London and New Zealand coincide as to date. This is even more

striking when we examine the weekly return for the deaths from the ninety-six large towns in England as shown in the table below :—

Week ending	Ninety-six Large Towns, including London.	London County.	London Outer Ring.
19th October	1,895	371	390
26th October	4,482	1,256	969
2nd November	7,412	2,458	1,705
9th November	7,560	2,433	1,535
16th November	5,916	1,665	907
23rd November	5,106	1,178	606
Totals	32,371	9,361	6,112

Here we find that the crest was reached on the weeks ending 2nd and 9th November, differing little from our own. It is evident, then, that the second epidemic wave did not travel as such to New Zealand from England.

A study of the general epidemiology of the recent outbreak shows that this division into a primary mild and a secondary severe and explosive wave is, so far as our information goes, universal.

In Glasgow there was a distinct second-wave explosive outburst on the 21st September, chiefly among children at first, and Spain also seems to have developed a secondary wave of great intensity about this time. The next marked explosion (a term which seems best to describe this type of epidemic) of which we have definite information was that on the transport "Tahiti" at Sierra Leone on the 26th September. The infection in this case was, we know, brought from Europe on a naval vessel forming one of the convoys; and it may be well to point out here that the infection seems so far to have centred round maritime trade centres, such as Glasgow and Portsmouth, suggesting the influence of shipping and the movement of troops from overseas.

The Cape Town epidemic was the first of the conspicuous outbreaks in a general population, and this took place about the first week in October; and in this connection I may mention that a New Zealand transport called at Cape Town on the 25th September, left on the 27th September, and on this boat there was already an epidemic of influenza picked up at Durban. Though the troops went ashore at Cape Town, and had an opportunity of picking up infection, only cases of a mild type arose during the voyage to Sierra Leone. There were some 150 of these, so that there was every encouragement for the exaltation of infective virulence. Yet a week after the departure of the troopship Cape Town was in the throes of a severe epidemic. It is scarcely possible that the infection was not already in Cape Town. We must suppose that it had at that time not developed its virulent character. A brief period of preliminary circulation among the Native cantonments will possibly be found to have been the factor which led to the heightened virulence.

In America the second wave seems to have first developed in Boston about the end of September, and thence it spread westward; but it was not until the week ending 16th October that it became general throughout the States, and even then had not attained a very high degree of virulence. In San Francisco influenza took on a severe form on the 21st October, and an explosion of great violence occurred, the peak of intensity being on the 27th October. Regarding Vancouver we have little information, but know that severe cases were *not notified* in the week ending 11th October.

In London it began on the 21st October; in France, among the troops, on the 8th October. We see, then, that this second epidemic wave throughout the world took on an explosive character and manifested itself in various places in outbursts of violent character but short duration, in which pneumonic complications were very prominent. The wave became pandemic in the later part of October and the beginning of November, just when the outburst came to New Zealand.

Probable Factors influencing the Epidemic.

It is difficult to explain the almost simultaneous world-wide outbursts which have characterized the second wave of infection. This wave has surprised and puzzled epidemiological students all over the world. Sir Arthur Newsholme, in an address published in the *Lancet* of the 23rd November, reviews the history of past epidemics, and points out that this secondary wave of October-November was one never before experienced. The interval between the first and second waves was shorter than any previous epidemic, being sixteen weeks instead of from thirty-five to seventy weeks. Moreover, the first wave in Britain was in midsummer, a hitherto unknown experience; and then came the early autumnal second wave, of very brief duration but great severity, whereas generally the waves appear in winter or spring.

Movement of Troops.—Sir Arthur Newsholme accounts for this unusual outbreak by the abnormal state of the world's population resulting from the war—the huge masses of troops being hurried from one country to another in conditions of unavoidable crowding, the massing together of men from far and near under unaccustomed conditions and before they had an opportunity to acquire gradually some degree of immunity, the rapid transference of infection among the susceptible men, and so on. Successive waves of infection of increasing virulence are thus brought into a country and so add to the infectivity of existing disease.

In a degree proportional to our population in this country we also must have these successive additions of influenzal infection of increasing virulence. The type introduced in May would be less infective than that arriving in September and October, and this must have had an influence in enhancing the virulence of the primary wave. In Auckland, on the 11th and 12th October, two troopships and the Vancouver mail-boat arrived from overseas, the latter with about 80 cases of influenza, and the former with men convalescent from attacks in English camps. Among these carriers may have been present.

Infection in Ships' Crews.—Reference has already been made to the apparent influence of infection in the maritime ports. In New Zealand the incidence of the disease seems specially heavy among the crews of vessels passing up and down the coast.

Climatic Influences.—Influenza is generally a winter disease, and for the last two years the weather all over the world has been unusually wet and cold, both in summer and in winter. In New Zealand we have suffered also, and catarrhal diseases have been encouraged. It is of interest to note that horticulturists throughout Britain, America, and New Zealand have suffered from a series of epidemics among fruit-trees and vegetables during the same period. Wet and cold favour the development of all low forms of vegetable life, whether preying on human beings or on the higher plants. October was a particularly wet, stormy month, especially in Auckland, and this must have had an influence in stimulating the activity of the catarrh-producing organisms, especially those causing pneumonic complications.

The rise each winter in deaths from pneumonia and bronchitis is well known, and applies equally to New Zealand. The Principal Medical Officer, Featherston, in his report draws attention to the influence of the exceptionally severe weather of July and August in encouraging the first epidemic wave, while after the storm of the 6th and 7th November, when the second wave was in progress, the improvement in the weather was followed by a marked diminution in the proportion of pneumonic complications.

It is obvious that one effect of bad weather—the driving of people into shelter—must directly influence the spread of infection by contact. In addition to this the effect of cold and wet in diminishing resistance must be considered.

Aggregation of Population.—The influence of troop-trains in spreading infection has been mentioned, and we have followed the spread of the epidemic from Auckland to the various camps by this means. In the same way the railways have been a potent factor in carrying influenza during the movement of population from country to town in connection with Peace celebrations at the time when the epidemic was in its early stages of development.

Lack of Natural Immunity in New Zealand.—The absence of acquired immunity in a rural population is well known, and in New Zealand such population predominates. Moreover, the isolated position of the average country settlers and the general good health of the community must result in an unusual lack of immunity of catarrhal and pneumonic diseases in the New Zealand people. That such lack exists we know from the reports of the Medical Officers in charge of troops in the Expeditionary Force overseas. (See report on vaccination of New Zealand troops, *Lancet*, 16th October.) This peculiarity must have provided an admirable nidus for the reception and exaltation of the organism of influenza and its attendant complicating infections.

Summary.—Reviewing these factors making for the severity of the influenza outburst of November last we are able in a measure to grasp the position. The influenzal infection found in 1918 world-wide climatic conditions favouring its spread. It found gatherings of troops to exalt its virulence, and by the transference of such troops about the world it was able to reach the other countries with ever-increasing infectivity. The influence of the appalling prison camps in Germany and Austria has not been discussed, but among the starved crowded soldiers there abnormal infections would find a good breeding-ground. Either in this way or simply from camps of unprotected persons the ordinary influenzal virus became associated with pneumonia-producing organisms capable of unusual potency in favourable conditions. Such conditions presented themselves in New Zealand in the climatic disturbances, the unusual movements and aggregation of troops, and the natural lack of immunity of the people. The virulence would increase naturally as the primary epidemic spread over the country, and as the successive accretions of higher virulence came from overseas. At Auckland it found an aggregation of susceptible troops at Narrow Neck which would doubtless give it an extra fillip, and just following this came the overseas vessels with a further addition of infectious cases. The result was an explosion, just as in other countries similar accretions led finally to similar outbursts about the same time. Owing to the aggregation of persons of the most susceptible age in the training-camps the effect of this epidemic was of course felt there more perhaps than among the general population, and but for the effective measures taken by the Medical Staffs would have resulted in an even higher mortality.

R. H. Makgill, Lieut.-Colonel.

REPORT OF CAPTAIN J. W. CRAWSHAW, N.Z.M.C., ON CASES OF CEREBRO-SPINAL FEVER AT FEATHERSTON MILITARY CAMP FROM JULY TO DECEMBER, 1918.

Detailed Account of Cases.

The total number of cases was 40, of which 36 were soldiers and 4 civilians. During July 4 cases were admitted; during August, 6 cases; during September, 1 case; during October, 7 cases; during November, 18 cases. One civilian case was seen in July, 1 in October, and 2 in November.

With two exceptions all the cases admitted during November had suffered from attacks of influenza. The large number of cases admitted that month was undoubtedly due to the great number of men in the temporary hospitals during the epidemic of influenza which occurred in the camp at that time. With every available building in use as a hospital a considerable degree of congestion of influenza cases was unavoidable, and no steps could be taken to identify and isolate meningococcus carriers.

It is not necessary to detail the symptoms of disease, but two distinct types of cases could be distinguished—the meningeal type and the septicæmic type. In the former the meningeal symptoms predominated, and loss of consciousness occurred early in the disease, generally within twelve hours of the onset of the symptoms. Of these cases 6 were unconscious on admission to the cerebro-spinal meningitis ward. Within twenty-four hours after the commencement of treatment consciousness had generally returned, and with the exception of one all recovered, so that rapid loss of consciousness is not necessarily an unfavourable symptom provided treatment is commenced early.

In the septicæmic cases the meningeal symptoms are not prominent. In 5 of the cases the meningococcus was found in the blood and was not at any time found in the C.S. fluid. The following case may be taken as typical of the milder form of this type of the disease. The onset was acute, and the most characteristic symptom was the occurrence within a few hours from the onset of the illness of a hæmorrhagic rash. This was most frequently seen on the arms and legs, especially on the extensor surfaces and in the gluteal region. In the severe form—the so-called fulminating cases—the hæmorrhagic spots increased rapidly until purple areas 2 in. or 3 in. in diameter were scattered over the legs and arms, and very numerous spots were present on the body. The most rapidly fatal were three cases of this type. The first two of these men died within eighteen hours of the first onset of the disease, while the other died after thirty hours' illness. In each of these cases the man was conscious till within an hour or even less of his death. One case (26) may be specially mentioned. Ten days before admission he had an attack of influenza. On the morning of admission he had a rise of temperature with hæmorrhagic rash. There was no headache, no vomiting, no rigidity of neck or Kernig's sign, or other symptom of meningitis. A specimen of his blood was found, after only twenty hours' incubation, to be swarming with meningococci. It was not until the evening of the third day after admission that vomiting and slight stiffness of the neck occurred. A lumbar puncture was done, and the C.S. fluid was found to be slightly turbid and to contain pus and meningococci. At this stage Kernig's sign was not present, though it developed later. He subsequently died. This case clearly shows an initial blood-infection which was followed by meningitis. The contrast between this case and those typical of the meningitic type of the disease is very marked.

Diagnosis.

In 23 out of 36 military cases the meningococcus was found in the C.S. fluid. In 5 others, although no organisms could be detected in the C.S. fluid, the fluid contained an excess of polymorpho-nuclear leucocytes. In 2 cases no L.P. was done, while in 2 others the examination was negative. In 8 cases, therefore, the diagnosis was not definitely confirmed by the discovery of the meningococcus in either the blood or the C.S. fluid. Of these 6 occurred in November. It was very unfortunate that the staff of the bacteriological laboratory was much depleted during the influenza epidemic, and especially that Lieutenant Ross was ill during the whole of the time the cases were occurring. The great rush of the work during the epidemic and the depleted staff probably accounts for some of the negative results. The symptoms and signs in all the cases were so typical and so similar to those in which the meningococcus was found in either the blood or C.S. fluid that no other diagnosis could be arrived at.

Pathology.

Bacteriological examination of either C.S. fluid or the blood or both was made in all the cases. Blood cultures were made from 24 cases. The meningococcus was found in 13 of these, or 54 per cent. This is a much higher percentage than is usual. Muir and Ritchie state, "In a certain number of cases it [the meningococcus] was obtained from the blood during life, but cultures in most instances give negative results" (p. 242). Foster and Gaskell mention that "Elser and Huntoon were able to grow it in 11 out of 41 cases." The successful cultures made in camp were in all probability due to the early stage of the disease at which the blood was taken for examination. It was a routine practice that a blood culture was made as soon as possible after admission to the ward. The Medical Officers were on the lookout for these cases, and any man presenting suspicious symptoms was carefully watched. The result was that practically all the cases were under treatment within twelve hours of the onset of symptoms. I am strongly of opinion that these results would have been even better had the laboratory staff not been so depleted by the influenza epidemic. The fact that the ward was situated some distance from the laboratory may also have resulted in failure in one or two instances, and owing to the cooling of the culture medium in transit to the laboratory. In any case, with the best of arrangements, there will always be a large percentage of failures in blood culture, for it is not possible to procure more than a very minute percentage of the blood of a particular patient. A negative result in the blood culture is not nearly so significant as a negative result in the C.S. fluid, of which an amount may be withdrawn which is considerably in excess of the normal quantity of that fluid.

These results have an important bearing on the question of the route by which the meningococcus reaches the sub-arachnoid space. Two principal theories are held: (1) That the organism reaches the sub-arachnoid space by the communication which has been shown to exist between the

lymphatics of the upper portion of the nasal septum and the sub-arachnoid space; (2) that a blood-infection precedes the meningitis.

The cases which this report covers are probably not numerous enough to establish the matter, but I am strongly of opinion that the second of these two theories is the more likely to be true. The fact that in 5 cases the meningococcus was found in the blood while it was absent from or not found in the C.S. fluid strongly supports this view. In one of these the cultures were sent to Dr. Pearson, of Christchurch, and he was able to absolutely confirm the identity of the organism. Case 26, previously mentioned, is also a very suggestive one, for there was a very intense blood-infection, as shown by the culture after only twenty hours' incubation, literally swarming with organisms. At that time there was no headache, no vomiting, no rigidity of neck, no Kernig's sign, or any other of the usual symptoms of meningitis: these developed three days later, and the C.S. fluid was found to be infected.

The meningococcus is very frequently present in the upper part of the naso-pharynx and nasal cavities, and there has been shown to be a definite communication along the olfactory nerves between the sub-arachnoid space and the lymphatics of the upper part of the nasal septum. It would thus appear that a large number of ready-made channels for infection of the meninges are present. It is, however, important to consider the direction of the flow of fluid through these communications. The lymphatics of the upper part of the septum have been injected in the dog by coloured fluids forced into the sub-arachnoid space under pressure. This appears to me to be the direction of the flow, and in all probability the C.S. fluid normally escapes by this route and enters the lymph-stream. If the direction of flow were the reverse operations on the nasal cavities would be more frequently followed by septic infection of the meninges than is the case, for organisms usually travel with the lymph stream and not against it, as is seen every day in lymphangitis in the limbs. It may be pointed out also that there are no lymphatic glands intervening between the nasal lymphatics and the sub-arachnoid space, and thus no filtration action such as takes place in the groin or axilla is possible.

It is usually dangerous to argue by analogy, but the following points are suggestive. The closely allied diplococcus, the gonococcus, occasionally produced arthritis, and the organism has been recovered from the synovial membrane of the affected joint. In these cases no other routes than the blood-stream is open to it to reach the joint. It apparently has an affinity for the synovial membranes. The pneumococcus, like the meningococcus, may be present in an apparently healthy throat. The occurrence of pneumonia is not necessarily due to its direct passage down the trachea, which is against the stream produced by the action of the cilia on the epithelial surfaces. It is probable that the blood-stream is first invaded, and the pneumococcus, having a peculiar affinity for lung-tissue, settles there. In a similar manner the meningococcus has a special affinity for the meninges. That it does not always attack the meninges is, however, shown by the 5 cases in which the C.S. fluid was sterile while the blood was infected.

Complications.

These were remarkably few. Two cases had double vision and slight facial paresis. Four cases of epididymitis occurred, and in none of them was there a history of gonorrhœa or any evidence of urethritis: 3 had synovitis, 1 knee-joint, 1 both knee-joints, 1 elbow. All the cases recovered. No mental defects were apparent in any of the men after recovery from the disease.

Treatment.

With the exception of 2 cases, who were regarded as cases of mild blood-infection, L.P. was done in all the cases as soon after admission to the ward as possible. Anti-meningitic serum was injected intrathecally after the withdrawal of the C.S. fluid. This procedure was repeated every twenty-four hours for from three to seven days according to the severity of the symptoms and the effect of treatment upon them. The first case which occurred was extremely acute, with high fever and a profuse, rapidly spreading hæmorrhagic rash. He died about eighteen hours after the onset of his illness and presented no definite meningeal symptoms, and was conscious till shortly before his death. The second case recovered after five L.P. and intrathecally injections of serum. The third case was treated in a similar way, but, although he improved at first, his progress did not continue satisfactorily, and it was decided to administer intravenous injections of serum. At first it appeared to be beneficial, and it was continued until a serum rash developed. His temperature became very irregular, and his general condition did not improve. It was decided to administer a further injection of serum, and this was followed by symptoms of anaphylactic shock—extreme flushing of the skin and sweating, rapid failure of respiration, with cyanosis and later cardiac failure. Although this case terminated so disastrously it was decided to continue treatment by this method, but to commence the injections as soon as the case was admitted to the ward. In the great majority of subsequent cases this was done The tenth case was the first in which the blood was subjected to bacteriological examination, with the result that the meningococcus was found in it, the identity of the organism being confirmed by Dr. Pearson. This was a mild septicæmic case, and he recovered after a subcutaneous injection of 35 c.c. of serum. The C.S. fluid was quite clear, did not contain pus or organisms, and was sterile on culture. This case clearly established the possibility of blood-infection with the meningococcus, and strongly supported the view that the infection of the blood is primary and the infection of the meninges is secondary. The treatment of intravenous injections of serum in the early stage of the disease was placed by this observation on a rational basis.

The quantity of serum given by the method varied considerably according to the severity of the case, as much as 120 c.c. having been injected at one time. In the 27 military cases which recovered in which the treatment was carried out the average amount of serum injected was 146 c.c., the quantities varying from 50 c.c. to 319 c.c., 6 of the cases receiving over 200 c.c. In the severe cases the object aimed at was to inject as large a quantity of serum as was considered safe in the first twenty-four hours. For example, in a case which was one of the worst, L.P. was done at 2.30 p.m. on the day of admission, and 25 c.c. of serum injected intrathecally and 100 c.c. intravenously. At 9 a.m. next day 95 c.c. serum was injected subcutaneously, and at 2 p.m. L.P. was repeated and 25 c.c. serum injected intrathecally and 75 c.c. intravenously, so that in twenty-four hours 50 c.c. was injected intrathecally and 175 c.c. intravenously and 95 c.c. subcutaneously, a total of 245 c.c. This boy was in a desperate condition on admission, being quite unconscious, extremely pale instead of the usual dusky appearance, and his pulse was very feeble. He began to recover consciousness the following day, and, though very confused mentally for two or three days, made a complete recovery, convalescence, however, being delayed somewhat by a synovitis of the right knee-joint.

In addition to the intravenous method, which, as will be mentioned later, has certain drawbacks, serum was injected subcutaneously in large quantities. The first injection of serum, however, in nearly all cases was given intravenously to secure greater rapidity of action. In the case of the baby treated at Featherston only one L.P. was done with injection of serum intrathecally, but the serum was administered subcutaneously, and the baby made an excellent recovery.

The injection was usually followed in seven or eight days, occasionally in six, by a serum rash. The severity of the rash did not seem to bear any relation to the amount of serum administered. The appearance of this rash was regarded as a contra-indication to more serum.

The intravenous injections were usually well borne on the first two or three occasions. Subsequent injections were on several occasions followed by a condition of extreme collapse which was very alarming. This condition was quite distinct from the condition of the man who died from anaphylactic shock. In that case the vaso-motor and respiratory centres appeared to be paralysed, and the man became extremely cyanosed. The heart was beating strongly when respiration ceased, and continued to beat for ten minutes afterwards. In the condition of collapse following intravenous injection the symptoms are those of heart-failure: the patient is cold and often sweating, the pulse becomes imperceptible at the wrist, and the respiration is somewhat sighing in character. These symptoms come on rapidly within three or four minutes of the injection. It is curious that the most severe of these cases occurred when no general anæsthetic was administered. It was very seldom that any collapse followed the injection when the patient was under chloroform. It was found that the administration of pituitrin, ½ c.c., repeated in fifteen minutes, was followed by quick recovery, and in less than an hour the condition of the patient was normal. Later on the practice of giving ½ c.c. of pituitrin prior to the injection was adopted, with apparently a greater freedom from collapse.

Although, as stated above, the early injections were generally free from symptoms of collapse, it is curious that the worst cases of this kind followed the first injection. Thus in the 34th case there was a severe blood-infection with hæmorrhagic spots, many as large as a shilling, all over the body, but most numerous on legs and arms. He had headache, vomiting, and slight stiffness of neck, but was quite clear mentally. At 12 noon on the day of admission L.P. was done under a local anæsthetic. An injection of pituitrin was given and the injection of serum commenced. He was in excellent condition at this time, but before 50 c.c. was injected he became very pale and rapidly lost consciousness. The pupils dilated and became fixed, and the conjunctivæ were insensitive. The injection was immediately stopped and more pituitrin was given, and the foot of the bed was raised. The pulse was imperceptible at the wrist. The respiration became very faint and sighing, and he became somewhat cyanosed. Artificial respiration was commenced, ether was injected subcutaneously, and hot application was made to the cardiac region. In about ten minutes he improved somewhat and he became conscious, but the pulse did not improve. During the afternoon he was very restless, and early in the evening he became unconscious again. He remained in this condition throughout the night, no pulse being perceptible at the wrist. During the following day, however, he improved, and in two or three days he was doing well, and he made a complete recovery. No more serum was given intravenously, but he received three injections subcutaneously, amounting to 130 c.c., without any ill effects. Owing in all probability to the prolonged circulatory depression the superficial portion of the skin, where the hæmorrhagic spots were present, separated in the form of sloughs during the second week. This was the only case in which sloughing of the skin was observed. In no other case, however, which recovered were the hæmorrhagic spots so large. Inquiry was made as to whether he had had any injection of serum before, but he stated that he had never had any serum administered previously.

The cause of this condition of collapse is not obvious. In case 34 referred to it was possibly an idiosyncrasy. In the others it cannot be due to this cause, for the previous injections had generally been well borne. The greatest care was taken to avoid injecting air into the vein. The injections were given from a funnel attached to the needle by a short rubber tube with a glass inspection-piece, and tube and needle were both filled before the needle was inserted into the vein. The serum was allowed to run in slowly by gravity. In one case the collapse followed the last three injections. Although occasionally air might find its way into the vein it is improbable that it would do so in three consecutive injections into the same patient. The local anæsthetic used for the L.P. can be excluded as a cause of the symptoms, for, although it was used very frequently when L.P. alone was done, no symptoms of collapse were ever noticed.

The average amount of serum used in the cases which recovered is as follows: In 29 cases the average intrathecally was 56 c.c.; in 27 cases the average intravenously was 146 c.c.; in 19 cases the average subcutaneously was 106 c.c. The smallest amount intrathecally to any case was 15 c.c.; the largest was 220 c.c. The smallest amount intravenously was 50 c.c.; the largest amount was 319 c.c. The smallest amount given subcutaneously was 35 c.c.; the largest amount was 185 c.c. The average total serum used in 31 cases which recovered was 277 c.c. The smallest amount was 50 c.c.; the largest amount was 645 c.c.

In the earlier cases treated in this way recovery was generally rapid, the temperature being normal in from four to eight days. Of the cases met with in November several of them ran a very irregular temperature, in some cases for four or five weeks. All these cases had previously suffered from influenza. Owing to the numerous cases occurring at this time, and also to there being a threatened shortage of serum, many of these cases had not received such large doses of serum in the early stage of the attack as they would have done. Whether this is the explanation, or whether the previous attack of influenza had reduced their resisting power, it is impossible to say. It was not considered advisable to use any more serum after the occurrence of a serum rash. These cases were accordingly treated by frequent L.P. and the administration of anti-meningococcal vaccines. In the early acute stages of the disease, when a virulent blood-infection is present, I have been averse to the use of vaccines, but in the later and more chronic stage I consider vaccine treatment not only safe but advisable. The vaccine was used in very small doses, about 45,000,000 at first, and repeated every day or every other day in gradually increasing doses, the interval being increased with the increase of dose. In several of the cases it would appear that the vaccine was very beneficial, and in no case could it be said that any harm whatever had resulted from the treatment.

In this chronic phase of the disease simple L.P. without the injection of serum was performed and repeated daily in many cases. Two men had L.P. done ten times, one man thirteen times, one man seventeen times. One of the women patients had it done thirteen times. There was never any septic infection of the tissues over the third and fourth lumbar spaces where the punctures were made, and none of the patients complained of more than a little local soreness.

Very little medicinal treatment of any kind was employed. For the headache morphia in doses of $\frac{1}{6}$ grain to $\frac{1}{3}$ grain was found extremely valuable in relieving the pain and quieting the restlessness of many of the patients. Pituitrin was found very valuable in combating the heart-failure following the intravenous injections. Many of the patients became very emaciated in the chronic form of the disease, and every effort was made to press as much food as possible on the patient. Incidentally it may be remarked that the ability to take food was a valuable indication of the favourable progress of the case. The patients were in rooms where an abundance of fresh air could be admitted, and this was regarded as a very valuable aid in treatment.

Results.

In the 36 military cases under treatment the deaths were 8, or 22·2 per cent. Two of these deaths were in the first three cases in which intravenous serum was not used in the early stages of the disease. In the remaining 33 cases 6 deaths occurred, or 18·2 per cent. It may be pointed out that one of these cases was admitted from influenzal pneumonia affecting both lungs, and it is doubtful if he would have recovered from the pneumonia apart altogether from the meningococcus infection. Another man was also suffering from pneumonia following influenza, and had a very large abdominal tumour, which was found post-mortem to be a huge pyonephrosis, containing over 6 pints of pus, which on culture gave a pure growth of staphylococcus aureus. He stated he had had a tumour in the side for some years, following a severe injury. Two of the other cases (13 and 15) died, the former one hour and the latter fourteen hours after admission to the ward. Of the remaining cases, one, as already mentioned, was an intense blood-infection, while another was an intense meningeal infection. Both these men were treated with large injections of serum, but the first died after fifteen days' illness, and the latter after sixteen days' illness. Of these 6 cases, therefore, 2 died before treatment had any chance to prove effective, and 2 had serious concurrent disease.

The death-rate, with the 4 civilian cases included, is 6 out of 37 cases—*i.e.*, 16·2 per cent. There were 5 cases in which the diagnosis was made on the clinical symptoms. If these cases are ignored and only those cases taken in which the meningococcus was found either in the blood or C.S. fluid, or in which pus was found in the C.S. fluid, the death-rate is 6 in 32, or 18·7 per cent.

Remarks.

During the influenza epidemic in November 14 men were admitted to the cerebro-spinal meningitis ward who had suffered from influenza, the date of the attack being noted. The average time from the commencement of the influenza to the commencement of the cerebro-spinal fever was eleven days—the extremes being six days and eighteen days. The cases had all been admitted to various hospital wards or temporary hospitals, and were doubtless contacts of cases of cerebro-spinal fever or of carriers of the meningococcus, and no particular significance can be attached to these figures. The usual routine of taking a throat-swab of men admitted to hospital and examining for meningococci could not be continued during the epidemic owing to the great number of cases admitted and to the depletion of the staff of the Bacteriological Laboratory. On this account no record of carriers could be obtained.

There was only one case which has any bearing on the incubation period of cerebro-spinal fever. This case had not suffered any previous illness and had been quartered in a tent, and as far as is known had not been exposed to infection till he entered the hospital ward as an

orderly at 9 a.m. on the 13th October. While on this duty two cases of cerebro-spinal meningitis were found in the ward, with one of which he was in close contact. On the evening of Saturday, the 16th, he had a severe headache, and vomited several times during the night. The following morning he had numerous hæmorrhagic spots on the arms, legs, and body. He had slight stiffness of the neck, but no Kernig's sign. A pure culture of meningococcus was obtained from his blood, but the C.S. fluid on two occasions was negative, both to direct examination and to culture. He made a rapid recovery. In this case the incubation of the disease was apparently under three days and a half.

J. W. Crawshaw, Captain, N.Z.M.C.

REPORT OF PRINCIPAL MEDICAL OFFICER ON PREVAILING DISEASES AT FEATHERSTON MILITARY CAMP, 1918.

Cerebro-spinal Meningitis.

This is dealt with in a separate report, and is amplified by a special report by Captain Crawshaw, N.Z.M.C., F.M.C.

Influenza Epidemic.

Featherston Military Camp experienced at the end of a quiet year the full force of the above, suddenly and disastrously. At the end of October it was noted at Tauherenikau that one C1 company was being affected by a more severe type of influenza than usual, apparently following the advent of some Auckland recruits. This company was promptly segregated and inhalated to limit the disease as far as possible.

Onset.—On Monday, the 4th November, with practically no preliminary increase in the main camp, the epidemic hit us with full force. We had a full camp—Featherston huts, Canvas Camp, Racecourse, Tauherenikau, and Papawai all carrying nearly their full complement—approximately 8,000 men. The following week's weather was of unexampled severity, on Wednesday and Thursday one of the worst gales experienced in the Wairarapa's history complicating our epidemic troubles. By Monday night (4th) our medical, nursing, and orderlies staff was badly depleted. On Thursday following the gale over 400 men were admitted, and by Saturday nearly 2,000 men were down.

Accommodation.—The bigger buildings—institutes, &c.—were first taken over, and then the huts (forty-three in all). Each of these was converted into a separate hospital unit, and staffed, equipped, and supplied accordingly. Considerable difficulty was caused by the constant dropping out through illness of these staffs, which were supplied and renewed from Reinforcement and other men in camp. All training perforce was stopped, and the well looked after the ill, their gallantry and devotedness being beyond all praise.

The hospital rotundas and one of the infectious blocks were utilized as base hospitals for all serious cases. There was to be had to best advantage such nursing and skilled treatment as was available from constant changes of staff through illness and death. At one time eleven nurses were down out of a total of twenty-one.

A central clearing-station, fitted with hospital beds, was set up in a near-by convenient institute. To this were taken less serious cases and transfers of improving patients from the rotundas. From it serious cases were removed to the rotundas. Constant siftings of patients from the periphery to the centre were made, and *vice versa*, according to the condition of the patients.

Pulmonary cases were segregated in rotundas and C.C.C. in order to lessen infective risks. Such, apart from cerebro-spinal meningitis, constituted our serious cases, the vast majority of whom were admitted during the heavy weather of the first week. After that period comparatively few, save those admitted moribund from sources outside camp, were noted; and I am convinced that under ordinary decent weather conditions at the beginning our serious cases would have been considerably fewer in number, being some 315 in all from influenzal complications.

In the first ten days we had primary cerebro-spinal meningitis (3), measles, and mumps. The usual steps were taken, and we were fortunate in that only one fresh measles and no further mumps cases occurred.

A convalescent camp was established. Convalescents were here segregated for eight days, undergoing systematic inhalation treatment prior to final discharge.

All assistance possible (*e.g.*, drugs, inhalation chambers, Medical Officers, &c.) was rendered to the neighbouring countryside and towns. This in turn was freely returned, particularly by Wairarapa South, which was untiring in its efforts to help the camp. Reference must be made here to the unsparing efforts of Mrs. Page, of Featherston, and a small band of voluntary workers, who toiled unceasingly making invalid delicacies for hospital patients and convalescents at a time when such was of inestimable value. Other ladies came forward as V.A.D.s, and one laid down her life in heroic endeavour.

Hospital Admissions.—November, 3,174; December, 6: total, 3,180. A comparative table of daily admissions, number in hospital, and number of serious cases is appended, showing the rapid decline of the epidemic.

Serious Cases:—	Total.	Recoveries.	Deaths.
Cerebro-spinal meningitis	19	15	4
Pneumonic influenza	314	153	161

Treatment.—Apart from general routine treatment for plain influenza, in which sod. sal. was of great value, that of pneumonic influenza was largely symptomatic. Apart from nursing no special drug or line of treatment seemed to be outstanding. Alcohol (*e.g.*, whisky, brandy, or rum) in my opinion proved of great value in the epidemic, and I am convinced that many lives were saved and illnesses averted by its use during the epidemic in camp. The constant and fairly heavy drinker was not markedly benefited by its use when ill. It was noted that the heavily built, deep-chested type stood pneumonic infection badly, and that the leaner type was the reverse. Returned men stood lung complications badly, and appeared to have no resistive power.

Age seemed to have a marked influence on incidence, the youthful and those over fifty being comparatively immune, as the age-incidence seemed to lie between twenty-five and forty.

In the pneumonic type nursing loomed very largely. Out of a total of 314 men placed on the serious list from direct pneumonic complications, the fact that 50 per cent. recovered bears eloquent testimony to the devoted and excellent nursing under very trying conditions. One must remember that many were admitted to hospital from outside camp in a moribund condition.

Complications were relatively few. (*a.*) Empyemata: Two, one since tubercular, the other recovering. (*b.*) Pulmonary phthisis: One, followed pneumonic type. (*c.*) Cardiac sequelæ: Relatively not a marked feature, though one sudden death occurred during convalescence. (*d.*) Mental aberrations: Not marked, but one case. (*e.*) Simple pleurisies: Not uncommon. (*f.*) Pulmonary abscess: Not noted. (*g.*) Venous thrombosis: Two, both left femoral, and both did well. (*h.*) Cerebro-spinal meningitis: This is dealt with in a separate memo, amplified by a special report by Captain Crawshaw, N.Z.M.C., F.M.C.

Bacteriological Investigations.—Unfortunately, owing to the Camp Bacteriologist having gone down early in the epidemic, practically no work on these lines was possible. Latterly a small supply of mixed streptococci and staphylococci vaccine was obtained from Christchurch; but, owing to the fact that few patients remained, no reliable data could be formed as to its value, although it apparently assisted some.

Preventive Measures, on general lines, were early adopted. Inhalation chambers (of value), systematic gargling, avoidance of crowding, and cancellation of leave were amongst these.

Place must be found here for reference to the splendid way in which combatant units responded to our call for aid, and to the assistance given us so freely by Headquarters. It was a revelation of human self-sacrifice.

The deaths of Sister Wishaw, Captains Christie, Wheeler, and others of our corps is to be greatly deplored, sadly illustrating how unsparing of itself and its efforts had been the N.Z. Medical Corps, Featherston, in combating the scourge which had so suddenly descended upon us.

Return of Admittances, &c., Featherston Military Hospital, as from 11th November, 1918, to 30th November, 1918.

Date.	Admitted.	Serious Cases.	Daily remaining.	Date.	Admitted.	Serious Cases.	Daily remaining.
Nov. 11 ..	266	122	2,462	Nov. 21 ..	..	73	731
12 ..	137	129	2,269	22 ..	5	60	593
13 ..	83	145	2,247	23 ..	3	46	564
14 ..	87	143	1,849	24 ..	5	40	518
15 ..	92	141	1,717	25 ..	6	29	407
16 ..	37	145	1,533	26 ..	1	20	360
17 ..	32	128	1,343	27 ..	6	21	328
18 ..	29	91	1,246	28 ..	3	20	295
19 ..	18	97	1,010	29 ..	..	18	280
20 ..	10	84	813	30 ..	1	14	215

J. H. Graham Robertson, Lieut.-Colonel,
Principal Medical Officer, Featherston Military Camp.

REPORT OF PRINCIPAL MEDICAL OFFICER ON PREVAILING DISEASES AT TRENTHAM MILITARY CAMP, 1918.

Report on Medical Transactions, 1918.

During the year 1918, 10,392 T.A.B. inoculations were carried out. Throat swabs examined, 15,946; special laboratory examination of urine, 40; sputum examinations, 181; special bacterial cultures, 447; pus specimens examined, 289.

Spray Treatment.—As usual, "suspects" after throat-swabbings were sent to isolation camp until their swabbings were negative. Spray treatment on the whole was very effective in cleaning up post-nasal infections. All contacts of infectious cases—*e.g.*, measles—where the infection was suspected to be spread by the oro-nasal passages, were treated by inhalation, I think with good result, for although measles, German measles, and mumps occurred practically throughout the year there was nothing in the nature of an epidemic.

A new inhalation-room was built off the Medical hut, and during the November epidemic two large rooms were hurriedly appropriated and fitted up as inhalation-rooms with steam derived from the power-house to work the spray. This matter is referred to in the report on prevailing diseases.

Equipment, Wellington Racing Club.—All the equipment on loan from the Wellington Racing Club has been handed back.

The equipment for the operation-room arrived early in the year, and the room was then ready for use, and has been in use since. A copper cistern was attached to the hot-water service to store boiled water, which when allowed to cool provided cold boiled water for use in the operation-room.

A new building for use as a bacteriological laboratory was started, but work ceased in November, and the building remains in the same state—that is, only just commenced. The waiting-room at the Medical hut has been boarded in, and is now ready to be used as a massage-room, with accommodation for sixteen massage-tables. New electric pumps were installed during the year for dealing with the septic-tank effluent, and these pumps worked well. The hot-water service of the hospital has been improved by an altered arrangement. All huts appropriated during the year have been handed back. The gardens around the hospital have been well looked after, and have become quite a feature of the camp.

Officers, non-commissioned officers, and men worked excellently throughout the year, which was a very trying one. There were many changes in the personnel of this detachment, but everything worked smoothly.

It is with regret I have to record the deaths of four members of the corps during the year: Major J. B. Sale, a very able and hard-working officer; Private N. Farland, who did excellent work for many days during the November epidemic of influenza until he fell a victim; also Private J. Connell and Private J. G. Kirby, both very capable and conscientious orderlies, and both of whom succumbed to influenza.

J. P. D. Leahy, Lieut.-Colonel, N.Z.M.C.,
Principal Medical Officer.

Report of Prevailing Disease, 1918.

The weather conditions of 1918 were much worse than in 1917. Cold winds—gales—snow, and frost were very prevalent.

There was an increase in the prevalence of the following diseases:—

Influenza (see special report attached).				
Measles	45	cases compared with	11	in 1917.
German measles	65	,,	15	,,
Mumps	11	,,	7	,,
Tonsilitis	103	,,	49	,,
Syphilis	36	,,	18	,,
Scabies	84	,,	38	,,
Insanity	9	,,	2	,,
Bronchitis	34	,,	25	,,
Pleurisy	15	,,	13	,,
Ulceration of mouth	80	,,	1	,,
Cerebro-spinal fever	7	,,	2	,,

Remarks on the above Prevailing Diseases.—Of the measles cases none were serious. Of the mumps cases one arrived in camp after final leave, during which time he had been looking after his child, who had mumps at home. None of the cases of measles or German measles were serious, but caused a good deal of trouble on account of the necessary isolation. The increase in tonsilitis was probably due to the bad weather conditions. The increase in syphilis cases may have been due in part to men reporting to their Medical Boards that they were under treatment for the disease and then being sent into camp for treatment. It is difficult to account for the increase in scabies. The increase in insanity may have been due in part to the greater family anxieties of the 1918 recruits. Ulceration of the mouth showed a great increase because much more stress was laid on Vincent's disease in 1918 than in 1917.

Of the cerebro-spinal fever cases 5 occurred during convalescence from the November epidemic; they were up and about for a few days and then developed cerebro-spinal fever. All the cases died.

A peculiar dermatitis of the hands and exposed parts of the legs occurred in some men who were on cooks' fatigue, and the only thing they seemed to have done in common was to prepare parsnips for cooking. The parsnips were very dirty, but other men engaged in peeling parsnips were not affected, and the Government Analyst could throw no light on the matter. All cases recovered, but some had a bulbous eruption on their hands, which suppurated.

There was a diminution in the prevalence of the following:—

Gonorrhœa	134	cases compared with	155	in 1917.
Soft sore	1	,,	4	,,
Alcohol	6	,,	62	,,
Tubercle of lung and phthisis	6	,,	12	,,

Remarks on the above Diseases.—There was a very marked diminution in cases treated for the effects of alcohol. The decrease in the cases of alcoholism treated may have been due to the different type of recruit coming to camp in 1918. Those arriving in camp in 1918 were mostly married men, whereas those arriving in 1917 were principally single men.

Report on Influenza Epidemic of September and October, 1918.

Ordinary Influenza.

Ordinary influenza became an epidemic in Trentham Camp in September and October, 1918. From the 13th September to the 31st October (inclusive) there were 1,361 cases admitted to hospital. The excessive numbers of admissions overtaxed the ordinary hospital accommodation, and several huts had to be temporarily appropriated as hospital wards. The average stay in hospital was 4·89 days. Men discharged from hospital were not allowed to return to duty for some days afterwards.

The symptoms complained of were chilliness, headache, general aching, malaise, sore throat, and cough. The temperature on admission was variable, ranging from 100 to 103, with an almost constant tendency to fall immediately after admission, becoming normal, and remaining so in many cases, in twenty-four to thirty-six hours. Other cases in which the catarrhal symptoms were more marked and persistent took several days before the temperature became normal, even up to ten days. No case was considered bad enough to be put on the serious list, and there were no deaths, although about the last week in October a few cases showed more serious lung symptoms. On going into a ward where these influenza cases were, the most striking feature was the general coughing that was going on, pointing to the fact that the early symptoms were catarrhal.

There were no serious sequelæ except some transient debility and tacchycardia.

During the last week of this epidemic the daily admissions were: October 28th, 3; 29th, 7; 30th, 7; 31st, 2. November 1st, 5; 2nd, 7; 3rd, 4. On the 4th November the admissions rose to 29, and subsequently increased, the epidemic assuming increased virulence. A report of this second epidemic is here given.

"Pneumonic Influenza" Epidemic, November, 1918.

A serious epidemic of "pneumonic influenza" became manifest in Trentham Camp on the 4th November. It began suddenly, the hospital admission-rate rising seriously day by day until the 10th, and rapidly declining until the 21st. A few cases had occurred some days earlier of a suspicious nature, as mentioned. During the period from the 4th November until the 31st December there were admitted 1,566 cases. The average stay in hospital was 14·18 days. The parade strength of the camp on the 4th November was 3,270, and the strength on rolls was 4,354. There were 225 cases on the seriously-ill list, a total of 75 deaths attributable to the epidemic, and 5 cases remained in hospital on the 31st December, 1918.

Cases Admitted.

Date.	Cases.	Date.	Cases.
October 28	3	November 8	150
29	7	9	221
30	7	10	294
31	2	11	209
November 1	5	12	135
2	7	13	94
3	4	14	62
4	29	15	50
5	61	16	37
6	137	17	19
7	102	18	17

This epidemic seems to have been connected with week-end leave into Wellington, and the suddenness of its onset taxed the efforts of the Staff to the utmost in providing suddenly the necessary increased accommodation and the attendance on the sick. Barrack-rooms were appropriated as required and converted into temporary wards. Fresh palliasses filled with new straw and fresh blankets were provided for the ordinary barrack-room stretchers. Troops occupying required barrack-rooms were evacuated as quickly as possible into other huts or tents, and the appropriated huts were washed out and sprayed with formalin before the sick were put in. Medical orderlies were put into the huts, and a sister to supervise several huts. The epidemic, however, attacked so many of the medical orderlies and the nursing sisters that volunteers were called for from the lines to assist in attending to the sick in the huts. There was an excellent response to the call for volunteer orderlies, and many of them did really intelligent and excellent work under the supervision of Medical orderlies.

One of the early difficulties in the use of the huts was the absence of latrine accommodation, but the Officer in Charge of Works in camp supplied ordinary wooden pan seats and covers for oil-drums which were provided in the temporary wards. Sawdust and a deodorant solution was used to prevent any nuisance, and the arrangement worked quite satisfactorily. The pans were removed daily by the Camp Sanitary Staff.

Food was first of all served from the hospital central kitchen, later on from No. 8 cookhouse in addition, and later on still from No. 6 cookhouse.

Patients when their temperature became normal were given at least seven days convalescence on full diet, with an extra pint of milk and a pint of beef-tea daily, and was transferred to freshly equipped convalescent huts on both sides of Gaba Tepe Road. It was then that No. 6 cookhouse was appropriated for their use. None of the cases transferred to the convalescent huts had been on the seriously-ill list.

The serious cases were transferred to the main hospital buildings, so that all cases which became serious were transferred to the hospital proper, and no deaths occurred in the huts.

For the last three days of convalescence all patients were sent to the spray-rooms for inhalation treatment twice daily, and were then discharged from hospital.

During this epidemic there were no abnormal meteorological conditions observed.

Camp Precautions.

Troops were kept in the open as much as possible, and were warned against crowding together in barrack-rooms, &c. The picture-hall was limited to half its usual number—that is, to 300 men; the institutes were kept open, and all means of ventilation were used. All church parades were held in the open. The men themselves soon realized the seriousness of the position and helped in every way they could to avoid infection. Spray-rooms were frequented. Two new spray-rooms were fitted up; twelve spray-jets were made and connected up with the steam-pipe at the power-house, so that sixty to eighty men could be treated at one time for three minutes. Though at first the spray was rather coarse and wet, this was remedied, and the air of the rooms could be kept nearly saturated and filled with a "cloud." This "cloud" is the only satisfactory way of carrying out inhalation work, and consisted of a 1-per-cent. solution of sulphate of zinc. Sulphate-of-zinc solution, being an irritant, the "cloud" was used to secure as far as possible a topical application of the zinc-sulphate solution in a finely divided state to the naso-pharynx and upper respiratory passages. I cannot think that the inhalation at close quarters (especially through the mouth) of a coarse spray of sulphate of zinc would be good treatment during an acute catarrhal epidemic (see Bacteriologist's report). Used properly I think it should be of good service in a similar epidemic. That the treatment is of great use in destroying or at least markedly diminishing organism in the post-nasal space has been abundantly proved in this camp, but, of course, it has no immunizing powers, and fresh infection can practically occur immediately after. The reason why institutes, &c., were kept open was to avoid depressing the men by leaving their evenings unoccupied. Gargling was carried out by the troops, permanganate of potash being the gargle used, and in some cases washing of the nasal cavity by hand-douching was done.

The camp was placed in quarantine, and no one was allowed in or out without sanction of the Principal Medical Officer. Troop-trains were stopped; the last troop-train ran on Saturday, 2nd November, 1918. Men on leave were not to report back to camp.

The embarkation of the second part of the 43rd Reinforcements was cancelled, also the mobilization of the 51st Reinforcement. As regards this Reinforcement, however, mobilization was so far under way, and many recruits wishing to carry out their arrangements, that eventually 101 entered camp. The Auckland quota, however, was cancelled on account of the epidemic having such a hold in that province.

That the precautions taken proved effective—at least, to some degree—seems to be borne out by the fact that out of 3,270 men (parade strength) only 1,566 contracted the disease. This I think should be considered fairly good for a population living in such close contact as was the population of Trentham Camp during the epidemic.

Demobilization began during the epidemic by the establishment of a segregation camp on the site of the Engineers' Camp. This camp was self-contained, and had a barbed-wire fence round it. The Soldiers' Club was used as a recreation-room, small canteen, &c. Here men were kept for seven days, and had spray treatment twice daily until the time for their leaving camp arrived. Their B.R. Form 201 was then filled in, and in every case the temperature was taken, and if above normal the men were sent to hospital.

Medical Aspects of the Epidemic (November).

Up to the end of October cases diagnosed as influenza and admitted to hospital were considered all to belong to the same class of disease, and it was not until about Monday, the 4th November, when the admission-rate suddenly increased and the symptoms became more pronounced, that realization came that the severe form of "influenza" had attacked the camp. The pneumonic signs in the chest were usually apparent on the fourth or fifth day. On account of the disorganization of the ordinary routine of military medical work caused by the incidence of the disease among the N.Z. Medical Corps Staff complete statistics and notes are not available, but when the condition of affairs eased off there was a conference of Medical Officers who worked in Trentham during the epidemic, when all their impressions were put into report form.

There were 109 men who suffered from both the September and November epidemics, and 3 died. Of course, many men who had the disease in September had left camp before the second epidemic arose. In common with the whole of the Dominion great difficulty was experienced in looking after the sick. Nursing sisters and orderlies were taken ill wholesale, and in some cases batches of relieving orderlies arrived suffering from the disease and immediately became patients. Many of the voluntary helpers suffered the same fate. Office staffs were depleted; in my own office, of the whole staff only one lance-corporal remained on duty; and the work of the whole camp personnel became subservient to the medical requirements and rendered excellent help.

Clinical Signs and Symptoms.

Onset.—Usually characterized by headache and pain in back and limbs, with an initial temperature of 100 to 103. Headache was generally frontal, and usually persisted for forty-eight hours. In one case severe protracted headache was in evidence for five days, the only relief being given by morphia. Cases of severe headache were usually accompanied by complaint of most severe backache. Absence of coryza and cough at onset of disease was marked. Chilliness was often complained of, but rigor was rare. In some recorded cases headache and pain in limbs were present for at least forty-eight hours before pyrexia was recorded. With several patients persistent and excessive vomiting was a prominent symptom from the outset. Mode of onset was

usually very sudden, some cases being recorded of collapse on duty, the latter class being almost invariably of a severe toxic type.

Course of the Disease.—On admission temperature averaged 100 to 103, the pulse being usually remarkably slow (76 to 84) and bearing no proper relationship to the temperature. About the third day the latter frequently showed a remission to normal or below normal, this charge being frequently preceded by epistaxis. About the fourth or fifth day complications were usually initiated by a rise in temperature, cough, and expectoration—sputum being red, pink, or salmon colour, totally unlike the sputum of a typical lobar pneumonia, and becoming later on very copious and purulent, with streaks and spots of blood in it. Frequently, about the fifth day of the disease, a marked cyanosis developed in a number of cases—these usually ended fatally. At this stage respirations were slightly increased, but there was not the distress usual with lobar pneumonia of this degree.

Physical Signs.—Physical signs varied much in character. Lung complications in a more or less degree were present in some 75 per cent. of cases, and were of all degrees of severity. Impaired resonance, dullness on percussion, increased vocal resonance and fremitus, and crepitations were present in practically all cases of lung complications, with coarse râles and, later, high-pitched bronchial breathing and bronchophony similar to lobar pneumonia. Some cases were like a definite pneumonia, others like a patchy pneumonia.

Crisis and False Crisis.—Many cases ended by crisis, but in a large number crisis was false and the temperature often fell considerably below normal, cyanosis and dyspnœa increased, the patients becoming rapidly worse. A few cases remained dormant and then improved after a few days, but these cases were uncommon.

Lysis.—The temperature fell by lysis in a fair proportion of cases, and these generally made a fair recovery.

Complications.—(1.) Cyanosis: Cyanosis varied in degree, but was generally very dark, dusky or purple, and noticeable over the whole face and extremities.

(2.) Delirium: In the initial stages delirium was not common, but if present usually subsided in twenty-four hours. In those cases where delirium supervened about the fifth day it was usually of a low muttering type, though in several cases it was maniacal in character. Cases developing late delirium usually terminated fatally.

(3.) Pain: There was not much pain complained of except when a definite pleurisy occurred.

(4.) Epistaxis: Epistaxis, often of a marked degree, occurred frequently during the first week of the epidemic in about 25 per cent. of all cases.

(5.) Herpes of the lips was not unfrequent, and a few cases of herpes of the ears, usually both ears, occurred.

(6.) Thrombosis: One case of femoral thrombosis occurred in a woman civilian in hospital.

(7.) Jaundice was an uncommon complication. There were not more than 6 cases in the whole epidemic.

(8.) Vomiting was persistent and excessive in some cases, and was met with in some instances from the onset.

(9.) Meteorism occurred but rarely—about 6 cases in the terminal stage of illness, of which 4 died.

(10.) Diarrhœa: Although met with in a few cases diarrhœa was not a very prominent symptom.

(11.) Albuminuria was present in a few cases during the height of the fever, but cleared up and had no special significance, being merely a febrile albuminuria.

(12.) Hæmaturia with albuminuria: One case only noted, which recovered. There was a history of old kidney injury in this case.

(13.) Retention of urine was not uncommon, but yielded to ordinary treatment, being of a temporary character.

(14.) Acute suppression of urine: Only 1 case occurred, which terminated fatally.

(15.) Tongue and fauces: Extreme dryness of these parts, accompanied by more or less hoarseness, was common. In 1 case a patient developed acute laryngitis, which persisted for three weeks.

(16.) Pleurisy: A few cases with a limited effusion were noted. Small patches of dry pleurisy were fairly frequent.

(17.) Empyema: Only 1 case was observed. This was complicated by severe meteorism, and terminated fatally of pneumonic involvement of the other lung some weeks after operation.

(18.) Photophobia was not uncommon, although it was very marked in three cases.

(19.) Apoplexy: Two cases died suddenly in an apoplectic condition during the course of the epidemic.

(20.) Cerebro-spinal fever developed in 5 cases during the convalescent period, and all terminated fatally.

(21.) General distress: There was not the general distress present in most of the cases that one would expect in severe illness; even with marked cyanosis dyspnœa was not always pronounced.

Appended are some illustrative cases.

Treatment.—Treatment was conducted on general principles; no special drug was found to act as a specific. Medical Officers agreed as to the value of alcohol in treatment of serious cases.

Illustrative Cases.

Case 5.—P. A., age 34; service, five months: Admitted to hospital 17th September, 1918, complaining of headache and general malaise; no other symptoms. Complete recovery and discharge in a few days.

Case 6.—B. J. M., age 29; service, four months: Admitted to hospital 14th September, 1918, suffering from ordinary type of influenza, complaining of headache, general malaise, and sore throat. Discharged cured in six days after a quick recovery.

Case 7.—W. J., age 34; service, three months: Admitted to hospital 10th September, 1918, complaining of general aching, chilliness, severe headache, and sore throat. Temperature rose to 102·4 next day, the patient still complaining of severe headache and a troublesome cough and expectoration. Examination showed the presence of bronchial râles. Good recovery and discharge on 20th September, 1918.

Case 8.—F. W. E. A., age 26; service, six months: Patient admitted to hospital on 2nd November, 1918, immediately on his arrival from Awapuni. He complained of severe headache and acute pains in his loins, also severe epistaxis. On examination there were râles and rhonchi over both lungs, a troublesome cough with rusty sputum being in evidence. Temperature fell gradually during the fourth day, but rose to 104 next day, with increased pulmonary symptoms. Fall of temperature by lysis followed. A good recovery and discharge on 19th November, 1918.

Case 9.—D. A. J., age 36; service, five months: Admitted to hospital on Saturday, 2nd November, 1918, immediately on his reporting from Awapuni, from which camp he was sent with eleven other orderlies for duty. Complained of severe headache, cough, and expectoration, his temperature being 103. Examination showed general broncho-pneumonia and all the signs of the prevailing epidemic of pneumonic influenza. Convalescence in this case was slow, but eventually the pulmonary signs cleared up, and he was discharged convalescent on 26th November, 1918.

Case 10.—B. F. H., age 20; service, four months and a half: Admitted to hospital 2nd November, 1918, with the usual symptoms of influenza, accompanied by pain in the right chest below the angle of the scapula. On physical examination the characteristic signs of broncho-pneumonia were in evidence. On 5th November slight pleuritic rub were noticeable; on 9th very troublesome cough, consolidation of right base, râles, and rusty sputum. After running a high temperature for thirteen days the patient made a good recovery, although on the twenty-sixth day he had an acute attack of diarrhœa. Discharged from hospital cured on 9th December.

Case 11.—S. T. A., age 42; service, two months: Patient admitted to hospital 11th November, 1918, with a temperature of 102·2. He was groaning and held his head in an extremely retracted manner, Kernig's sign being absent. Morphia, $\frac{1}{6}$ gr., was given hypodermically, and patient slept all night. Physically he presented the usual signs characteristic of pneumonic influenza and progressed satisfactorily, his temperature gradually falling until it became practically normal on the eighth day. 19th November: Physical examination showed some consolidation of the base of his left lung, with moist râles and thick yellow sputum, his temperature suddenly rising to 102 during the day. His condition gradually improved, and the chest signs cleared up, his temperature becoming normal again on 30th November. On 6th December his temperature rose to 100, his cough became more troublesome, and he developed an attack of pleurisy below the right nipple. He made good progress and was discharged fit on 28th December, 1918.

Case 12.—S. A., age 20; service, four months: Admitted to hospital 5th November, 1918, for influenza with pulmonary complications. Physically there was consolidation of base of left lung, and small patches of consolidation in right lung. Very troublesome cough and salmon-coloured sputum, with acute epistaxis. After running a high temperature for ten days, with a comparatively slow pulse-rate, his temperature fell by crisis and he made a good recovery.

Case 13.—R. T., age 24; service, five months: Admitted to hospital 5th November, 1918, with the usual symptoms. This patient showed the characteristic diffuse patches of consolidation over both lungs, with salmon-coloured sputum and numerous râles, cyanosis being moderate in his case. His temperature fell by slight crisis on the tenth day to 100·6, and thereafter by lysis until it became normal on the fifteenth day after the onset of the disease. A good convalescence and recovery.

Case 14.—B. J. C., age 32; service, three weeks: Admitted to hospital 4th November, 1918, suffering from influenza. Patient seemed to be improving until 7th November, when his temperature began to rise and he showed signs of broncho-pneumonia, characterized by small diffused patches of consolidation over both lungs. He became markedly cyanosed, and, although his temperature fell and he seemed to be holding his own, his temperature rose again and he became comatose, dying on 13th November at 8 p.m.

Case 15.—G. H. S., age 23; service, three weeks: Admitted to hospital 4th November, 1918, with the usual symptoms of influenza. He became very delirious, and showed on examination marked evidence of broncho-pneumonia. He was moderately cyanosed, and had an irritable cough with salmon-coloured expectoration. An interesting feature of this case was the development of acute pain in the right wrist, accompanied by some œdema. This condition of epiphyseal pain was present in some severe cases during the epidemic. The patient made a slow convalescence, but all pulmonary signs cleared up, and he was put on the convalescent list on 22nd November, 1918.

Case 16.—W. C., age 26; service, three years and a half: Admitted to hospital 7th November, 1918, with the usual influenza symptoms, aggravated by extreme obstinate vomiting. Acute diarrhœa followed on 8th November, and on physical examination consolidation of the base of each lung was in evidence, but with few râles. This patient did not develop any cyanosis, but pulse and respiration rates ran up quickly, death supervening on 9th November at 8 p.m.

Case 17.—H. A., age 30; service, two months: Patient was admitted to hospital with ordinary influenza. There were no physical signs in the lungs on admission, but on 19th October his cough became annoying, accompanied by a characteristic yellow sputum. On 28th October

he was transferred convalescent to "Izard's." 3rd November: Admitted to hospital from "Izard's" with a temperature of 103·4, troublesome cough, rusty sputum, and consolidation of both bases. Respiration was painful, and rose to 28; became slightly cyanosed; but his temperature fell by a modified lysis, and good recovery followed.

Case 18.—S. D. G., age 29; service, four months: Admitted to hospital 8th November, 1918, suffering from pneumonic influenza. Acute delirium was manifest, slight cyanosis, shallow breathing, and blood-tinged sputum. On physical examination râles were heard at bases of both lungs. 20th November: Dullness and bronchial breathing at base of right lung, but patient comfortable. 23rd November: Crisis. Râles on both lungs; still some dullness right base; no bronchial breathing. 30th November: Lung condition quite cleared up. Patient fit and well.

Case 19.—T. T. F., age 39; service, four years: Admitted to hospital 15th November, 1918, with double pneumonia (influenzal). Patient very delirious; temperature 104, pulse 128, and respiration 28. The delirium in this case was most marked, violent spasms alternating with periods of low muttering delirium. Irritating cough and typical salmon-coloured sputum were in evidence. 19th November: Crisis, accompanied by extreme collapse, with a weak pulse; rapid shallow respirations (up to 58) almost caused the case to terminate fatally; but a plucky spirit and free administration of stimulants pulled the patient through, and, though convalescence was slow, discharge from hospital followed on 4th December.

Case 20.—W. K., age 25; service, seven months: Admitted to hospital 5th November, 1918, with pneumonic influenza. Severe cough, rusty expectoration, and acute migraine. Examination showed patches of consolidation over both lungs, and numerous râles and rhonchi. Temperature fell by lysis, and patient was transferred to convalescent quarter on 15th November, 1918.

Case 21.—W. W., age 30; service, five months: Contracted pneumonic influenza on 11th November, and was treated in Hut 129 till 15th November. During the time he was in Hut 129 his temperature fell to 100·6, but on the fourth day after the onset of his attack he was seized with severe vomiting, the temperature rising to 103·2, accompanied by a racking cough and rusty sputum. Examination revealed dullness at base of left lung, and numerous crepitations and râles. The pulse-rate was generally low throughout in comparison with his temperature, the highest recorded pulse-rate being 104, with a temperature of 104. The vomiting was severe and protracted, but after his crisis on the eighth day he made a good recovery.

Case 22.—W. G., age 30; service, four years: Admitted to hospital 18th November, 1918, with a temperature of 102·8. Patient was extremely cyanosed, and was troubled excessively with his breathing. Both lungs were dull on percussion, with moist râles and crepitations. Respirations became very laboured, and the cyanosis gradually became extreme, while the heart-sounds were hardly discernible. Coma finally supervened, with death on the fourteenth day.

Case 23.—W. J. A., age 42; service, four years.—Admitted to hospital on 28th November, 1918, with pneumonic influenza, temperature being 102, pulse 96, breathing very shallow and difficult, and marked laryngitis. Patient improved somewhat for a few days, but on the fifth day he became much worse, the temperature and pulse gradually rising in frequency, with increasing delirium and cyanosis. Physically there was dullness over both lungs, moist râles, and a well-marked bronchopony. The delirium became very marked, of a low muttering, incoherent character, with very difficult breathing and heavy perspirations. The cyanosis became extreme, the nails, lips, ears, &c., being almost black. On the tenth day after the onset of the disease the temperature rose to 105, and pulse to 140, death supervening at midnight.

Case 24.—H. B. J., age 33; service, one month: Admitted to hospital 15th November, 1918, temperature on admission being 99 and pulse 72. The temperature rose rapidly during the day to 104, the pulse (94) being low in comparison. On inspection the patient was deeply cyanosed, being a dusky blue in colour, and was unconscious. His chest was full of moist râles, with a dullness at right base and bronchial breathing, while the sputum was very copious and blood-stained. His condition slightly improved during the next four days, when the temperature fell by crisis, and, with the exception of an irritable cough, good convalescence and complete recovery followed, the patient being discharged on 9th December.

J. P. D. Leahy, Lieut.-Colonel, N.Z.M.C.,
Principal Medical Officer.

Bacteriological Report on Epidemic of Pneumonia Influenza at Trentham Military Camp, November, 1918 (abridged).

1. The outstanding features of the October epidemic were the frequent predominance of the influenza bacillus upon swabs from patients on admission to hospital, the negligible amount of second pneumonia, and no deaths. The introduction in November of a virulent influenza type should similarly have manifested itself in microscopic preparations; instead there was a decline in the prevalence of the influenza bacillus, and a rise into prominence of other organisms, including a diplococcus resembling pneumococcus.

Convinced that the causative organism should be sought in the incipient stages of the disease, when its presence would less likely be observed by a succeeding flora, sputum specimens were obtained from five severe cases at their onset. Direct smears showed an abundance of gram-positive diplococci, mainly oval but sometimes round, sometimes in short chains like a typical pneumococcus or streptococcus; in one case capsules were noted. In one of these specimens the influenza bacillus was also present in large numbers. In a further (sixth) sputum specimen gram-negative diplococci like catarrhalis were predominant. On blood agar these five sputa produced dewdrop colonies (like those of pneumococcus) in large numbers. This organism was isolated, and was found to be a "hæmolizing" gram-positive diplococcus closely resembling pneumococcus.

2. There seems no reason to doubt that several "species" are present during the development of the disease. Sputum examinations of twenty advanced cases showed the presence of—

(1.) Gram-negative diplococci of the catarrhalis type.

(2.) Gram-positive diplococci, sometimes oval, sometimes round, not infrequently in short chains like a typical pneumococci or streptococci, or perhaps both organisms.

(3.) Gram-negative minute rods of the influenza type. Usually these occurred variously associated, but in three instances influenza, in two catarrhalis, and in one pneumococcus or streptococcus occurred almost exclusively. The fact that these species are present does not suggest to me that they are jointly causative, for they are to be found associated at ordinary times creating no disorder. Biologically it is the occurrence of species of relatively equal virility that accounts for an association. The nature and extent of the epidemic, on the other hand, indicates exceptional virility, the accomplishment of which is effected only occasionally by a species, and much less likely by several simultaneously.

3. I have not found the influenza bacillus predominant in naso-pharyngeal specimens taken in early November. How long the causative organism or the secondary association remains prominent in the sputum I cannot say. I have observed, however, representatives of all the groups referred to in the sputum of patients in hospital five to seven days.

4. I have no definite evidence concerning the few relapses which occurred. If, however, by "relapse" is meant the clinical symptoms attending the transition from what I understand to be the first to the second phase of the disease, then I should say that in such relapses two cases showed a predominance of catarrhalis, but most of the cases observed showed a mixed infection in the sputum.

5. Unavoidably no valuable data are available concerning the deterrent effects of the zinc-sulphate spray upon the development of the disease. In several instances I observed a marked absence of organisms upon swabs rich in mucus, but taken soon after spraying. This has also been frequently noticed in the case of suspected meningococcus "carriers" retained in isolation and sprayed twice daily; it must be added that amongst these cases chronic catarrhal throats retained catarrhalis in large numbers despite spraying sometimes for well over seven days. It would seem that organisms superficially situated are destroyed by well-regulated spraying.

There certainly seems a danger in the use of unsuitable disinfectants or of disinfectants of excessive amounts. A case here was that of a man who remained in a dense zinc-sulphate atmosphere for ten minutes deeply breathing ten breaths at a time successively through each of his nostrils and his mouth. That night and the following day he was coughing up a muco-purulent sputum which showed enormous masses of squamous epithelial cells and polymorphs, but scarcely a trace of organisms: such a throat I consider to be more vulnerable after spraying than before. Further, it was a fact that some of the operators of the spraying-apparatus who frequently remained in the spraying-room were attacked during the November epidemic. Several soldiers stated, moreover, that they had sore throats after excessive spraying. These, however, were the exception; the prescribed time—viz., three minutes—in a zinc-sulphate "cloud" appears to have obviated injury to the respirating tract.

I believe the zinc sulphate is certainly a disinfectant, and that it would at least reduce if not exterminate any of the organisms mentioned if superficially situated. Its beneficial effects, however, may have been nullified by the many chances a susceptible individual had of being infected and reinfected, and by the failure of the spray to effect its purpose against so virulent an organism in a sufficiently small number of applications.

6. The vaccine question is best considered in conjunction with the ætiology of the disease. Vaccine treatment was not used in Trentham.

Not much is known of the ætiology of bacteria, but that an organism can exist in an individual without producing pathogenic symptoms, and that the same "species" transmitted to another does produce disease, shows differences of individual resistance and susceptibility. A similar conclusion may be reached from the fact that in a camp of, say, 3,270 men, 1,604 did not contract the disease, 1,566 did contract it, of which number 1,341 had it moderately and 25 seriously, and, finally, of the 225 serious cases 75 succumbed.

Considering the daily admissions to hospital during the epidemic period here, it is hard to see why the 1,604 should have remained unaffected unless they put up a resistance in response to the toxin superior to the remaining 1,566. The chances of that 1,604 being infected gradually increased from the first to the sixth day. On the sixth day 700 had been admitted to hospital, reducing the number out of hospital to 2,570, amongst whom no less than 294—nearly 10 per cent.—were affected and had to report sick on the next (seventh) day. Despite this, on the eighth day only 209 were admitted to hospital, and thereafter the numbers admitted gradually fell.

I do not believe that the 1,604 remained unaffected mainly because they were never infected, but rather that at the end they represented a "naturally selected" group who had not met an innoculum sufficiently large in relation to their resistance to overcome that resistance. A small infection, even if received several times, might possibly, like an administered vaccine or serum, have accounted for the comparative immunity of some or all of this number. The probability is that, had any one of them received a sufficiently large innoculum, their resistance would have been overpowered. The precautions taken in camp helped greatly in preventing a sufficiently large dose of infection in these cases.

In order to gain a rough idea of the aerial condition of the wards as compared with other places five blood-agar plates were exposed each for five minutes up and down throughout each of the following places: (1) Veranda outside Cottage Hospital; (2) Wairarapa ward; (3) Racing Club ward; (4) picture-hall; (5) canteen. On the first three plates only one or two colonies appeared,

none of which had the character of pneumococcus, streptococcus, or influenza. On the picture-hall plate, and especially upon the canteen plate, a very large number of colonies appeared, some of which closely resembled these species. Unfortunately, through being affected by the epidemic, I was unable to pursue this matter further.

Now, the fact that seven of the thirteen nurses were attacked despite this apparent purity of the ward air suggests that infection is occasioned by close contact of healthy with infected individuals. This seems to be the main cause.

The pictures, where men are close together, and the canteen, where at times the crowd eat and drink (particularly before retiring, when incubator conditions are best attained in the body), were likely centres of infection. Close contact in limited air-space or limited ventilation, by expectoration, possibly by the use of contaminated drinking-utensils, forks, spoons, &c., bed-clothing, dried pocket-handkerchiefs, in some cases by damage of the protective mucous membrane by the use of unsuitable disinfectants or disinfectants in excessive amounts—by some or all of these and similar means do I consider that the disease in general was transferred orally and nasally from one person to another.

R. W. Waters, Lieutenant, N.Z.M.C., Bacteriologist.

REPORT OF CAMP COMMANDANT ON MEDICAL TRANSACTIONS AND PREVAILING DISEASES FOR AWAPUNI TRAINING-CAMP FOR THE YEAR ENDED 31ST DECEMBER, 1918.

General Health.

The general health of the N.Z. Medical Corps in Awapuni Camp during the past year has been very good. With the exception of influenza there has been no prevalent or epidemic disease.

The following comparative table discloses the fact that, whilst the average number constantly sick per thousand of the strength was greater during the past than the previous year, it also shows that the increase was due entirely to the influenza epidemics of August and November, 1918:—

Average constantly Sick per Thousand of the Strength.

Year.	Influenza.	Other Diseases.	Total.
1917	0·80	7·35	8·05
1918	14·12	6·33	20·45

Cerebro-spinal Meningitis.

There were no admissions for this disease, but two men were admitted as carriers and were kept under observation. The cases are returned as "No appreciable disease."

Influenza.

The epidemic of August accounted for 54 admissions, the average duration of sickness in each case being five days. The disease was not of a virulent character—in no case did pneumonia appear as a complication. There were no deaths.

During the epidemic of October and November 174 cases were admitted to hospital, the average duration of the disease being ten days. There were no pneumonic complications among the October cases, but the cases occurring in November were nearly all of a severe type, and 27 subsequently developed pneumonia. There were two deaths in the camp hospital—one on the seventh day after admission, and the other on the tenth day—and five deaths out of hospital.

Origin of the Outbreak.—The average type of the disease with us without pneumonic complications would appear to have been introduced from Auckland, because on the 30th October two men were admitted to hospital, one of whom had been on leave in that city. This man was the first of the severe type of cases. He subsequently developed pneumonia, and died in Palmerston North Hospital twenty-one days later. On the 31st October 2 more cases were admitted, on the 1st November 5 cases, on the 2nd November 29 cases, and on subsequent days large numbers were admitted daily.

Grouping of Cases.—Type I: Cases of virulent influenza without pneumococcal infection. These cases would start off with high fever, intense headache, pains in the back and limbs, dirty tongue, and all symptoms of influenza of the common type, but more severe. After three or four days their temperature would become subnormal, and they would be very debilitated and depressed. Two cases were delirious for three or four days after their temperature fell. One was quite silly and talked nonsense, and passed urine and fæces under him for four days. Improvement was fairly rapid in all these cases.

Type II: Some patients developed cough early in the disease. This was soon accompanied by bright blood-stained sputum. The skin was often bluish-black in tinge, particularly about the face. Respirations slightly increased and slightly embarrassed. Physical signs indicated patches of consolidation mostly at the bases and behind, but occasionally in front. Epistaxis was not infrequent. Improvement was slow, the temperature falling by lysis. A few cases got into a semi-comatose condition and slept continuously; were dull and slow to answer when roused and spoken to.

Type III: Others developed severe pneumonic symptoms, practically always fatal, and in most cases quickly so: blueness, embarrassed respiration, blood-stained expectoration (usually bright red), heart gradually dilating, pulse quickly accelerating, restlessness, delirium, and death. The signs were nearly always those of broncho-pneumonia. Routine treatment in these cases was futile.

Accommodation.—At first—*i.e.*, in the August epidemic—all the cases were nursed in marquees or single circular bell tents. An attempt was made to use tentage during the October-November period, but owing to the severity of the weather and the increased rainfall many of the tents had to be abandoned and the cases moved into buildings. The marquees and tents were reserved for the severe cases, being to ensure a maximum of fresh air.

Vincent's Angina.

There were two admissions for trench-mouth. On the recommendation of the Dental Officer these cases were transferred to Trentham.

V.D.H.

Two cases were admitted and three invalided.

D.A.H.

Six admitted and three invalided.

Surgical Operations.

Any cases requiring surgical interference were dealt with at the Hospital, Palmerston North.

G. E. Gabites, Lieut.-Colonel, N.Z.M.C.,
Camp Commandant.

Table 1.—Showing the Health of the Troops for the Year 1918.

Average annual strength	9,181
Admissions to hospital	11,578
Average number constantly sick	343·99
Average sick-time to each soldier (days)	13·43
Average duration of each case of sickness (days)	10·80

Deaths.

In camp—		
Sickness	260	
Accident	1	
Suicide	1	
	—	262
Out of camp—		
Sickness	31	
Accident	1	
Suicide	1	
	—	33
Total		295

Disease.	Admitted to Hospital.	Died.	Average constantly Sick.
General Diseases.			
Group A—			
Cerebro-spinal fever	43	16	3·07
Chicken-pox	9	..	0·36
Cow-pox	1	..	0·02
Diphtheria	4	..	0·32
Enteric fever	1	..	0·01
German measles	120	..	3·60
Measles	128	..	6·04
Influenza	8,527	262	231·22
Mumps	11	..	0·38
Scarlet fever	6	..	0·46
Whooping-cough	1	..	0·13
Group C—			
Malaria fever	3	..	0·10
Group D—			
Pyrexia of uncertain origin	22	..	0·70

TABLE 1.—SHOWING THE HEALTH OF THE TROOPS FOR THE YEAR 1918—*continued.*

Disease.	Admitted to Hospital.	Died.	Average constantly Sick.
General Diseases—continued.			
Group E—			
Major septic diseases	4	..	0·24
Minor septic diseases	143	..	4·81
Group G—			
Pneumonia	15	1	0·73
Rheumatic fever	37	..	1·99
Sore throat	74	..	2·02
Tonsilitis	146	..	3·60
Other diseases	2	..	0·05
Group H—			
Tubercle of lung	9	2	0·92
Other tubercle diseases	3	..	0·27
Group I—			
Gonorrhœa	240	..	12·36
Syphilis	46	..	3·21
Soft chancre	5	..	0·37
Alcoholism	9	1	0·23
Scabies	159	..	5·68
Other parasitic diseases	36	..	0·32
Debility	18	..	0·98
Other general diseases	38	1	0·91
Local Diseases.			
Nervous	71	4	1·69
Mental	13	..	0·25
Eye	27	..	0·74
Other organs of special sense	43	..	1·13
Valvular disease of the heart	11	1	0·68
Other diseases of the circulatory system	62	1	1·93
Diseases of the respiratory system	185	1	6·25
Hernia	3	..	0·04
Other digestive diseases	419	..	14·47
Lymphatic system (except those included under heading of minor septic diseases)	1	..	0·01
Urinary system	52	1	1·98
Generative system (except soft chancre)	43	..	1·59
Myalgia	75	..	2·73
Other diseases of organs of locomotion	153	..	5·68
Connective tissue (except those included under the heading of minor septic diseases)	7	..	0·13
Skin (except those included under the heading of minor septic diseases)	92	..	3·07
Injuries.			
General	7	..	0·37
Local	401	2	15·49
Poisons	1	..	0·01
Effects of anti-typhoid vaccine	11	..	0·10
No appreciable disease	41	..	0·55
Suicides	..	2	..
Totals	11,578	295	343·99

ABSTRACT OF TABLE 1, SHOWING THE ADMISSIONS INTO HOSPITALS, DEATHS, AND AVERAGE CONSTANTLY SICK AMONGST THE TROOPS IN THE VARIOUS CAMPS AND STATIONS FOR THE YEAR 1918.

Camp or Station.	Featherston.			Trentham.			Narrow Neck.			Awapuni.			Hanmer.			Rotorua.		
Average strength	5,674			2,744			266			396			29			72		
Average sick-time to each soldier (days)	9·56			21·97			23·16			7·46			24·16			8·62		
Average duration of each case of sickness (days)	9·56			12·22			12·49			8·21			12·51			9·69		
Diseases.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.
General Diseases.																		
Group A—																		
Cerebro-spinal fever	36	10	2·60	6	6	0·47	..	..	..	..	..	..	..	..	..	..	..	..
Chicken-pox	4	..	0·19	5	..	0·17	..	..	..	..	..	..	..	..	..	..	..	..
Cow-pox	..	..	..	..	..	..	..	..	..	1	..	0·02	..	..	..	..	..	..
Diphtheria	4	..	0·32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Enteric fever	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
German measles	55	..	1·20	65	..	2·40	..	..	..	..	..	..	..	..	..	..	..	..
Measles	83	..	3·23	45	..	2·81	..	..	..	..	..	..	..	..	..	..	..	..
Influenza	4,522	157	107·30	3,227	79	99·80	432	17	15·94	253	6	5·59	43	3	1·49	51	..	1·10
Mumps	..	..	..	11	..	0·38	..	..	..	..	..	..	..	..	..	..	..	..
Scarlet fever	5	..	0·38	1	..	0·08	..	..	..	..	..	..	..	..	..	..	..	..
Whooping-cough	..	..	..	1	..	0·13	..	..	..	..	..	..	..	..	..	..	..	..
Totals	4,710	167	115·23	3,361	85	106·24	432	17	15·94	254	6	5·61	43	3	1·49	51	..	1·10
Group C—																		
Malaria	3	..	0·10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	3	..	0·10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Group D—																		
Pyrexia of uncertain origin	4	..	0·23	2	..	0·04	11	..	0·34	4	..	0·06	1	..	0·03	..	..	..
Totals	4	..	0·23	2	..	0·04	11	..	0·34	4	..	0·06	1	..	0·03	..	..	..

ABSTRACT OF TABLE 1, SHOWING THE ADMISSIONS INTO HOSPITALS, DEATHS, AND AVERAGE CONSTANTLY SICK AMONGST THE TROOPS IN THE VARIOUS CAMPS AND STATIONS FOR THE YEAR 1918—*continued*.

Diseases.	Featherston.			Trentham.			Narrow Neck.			Awapuni.			Hanmer.			Rotorua.		
	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.
General Diseases—continued.																		
Group E—																		
Major septic diseases—																		
Erysipelas	2	..	0·04	2	..	0·20	..	..	..	..	..	..	..	..	..	..	..	..
Totals	2	..	0·04	2	..	0·20	..	..	..	..	..	..	..	..	..	..		..
Minor septic diseases—																		
Inflammation of lymphatic glands ..	2	..	0·03	4	..	0·15	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of connective tissue ..	22	..	0·72	41	..	1·52	1	..	0·01	..	..	..	..	..	..	..	..	..
Abscess of connective tissue	20	..	0·53	6	..	0·14	..	..	..	1	..	0·01	..	..	..	..	..	..
Boils	3	..	0·05	12	..	0·35	..	..	..	..	..	..	..	..	..	..	..	..
Carbuncle	..	..	..	2	..	0·02	..	..	..	1	..	0·01	..	..	..	2	..	0·05
Onychia	8	..	0·28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulcer	4	..	0·18	11	..	0·70	..	..	..	..	..	..	..	..	..	..	..	..
Suppuration of lymphatic vessels ..	3	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	62	..	1·85	76	..	2·88	1	..	0·01	2	..	0·02	..	..	..	2	..	0·05
Group G—																		
Pneumoia	6	1	0·30	4	..	0·38	..	..	..	5	..	0·05	..	..	..	..	..	..
Rheumatic fever	30	..	1·68	2	..	0·08	..	..	..	3	..	0·07	2	..	0·16	..	..	..
Sore throat	35	..	0·91	27	..	0·61	8	..	0·30	4	..	0·20	..	..	..	..	..	..
Tonsilitis	35	..	0·70	103	..	2·80	..	..	..	8	..	0·10	..	..	..	..	..	..
Quinsey	..	..	..	2	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..
Totals	106	1	3·59	138	..	3·92	8	..	0·30	20	..	0·42	2	..	0·16	..	..	..
Group H—																		
Tubercle of lung	2	1	0·54	6	..	0·35	..	..	..	1	1	0·03	..	..	..	..	..	..
Other tubercle diseases	2	..	0·13	..	..	..	1	..	0·14	..	..	..	..	..	..	..	..	..
Totals	4	1	0·67	6	..	0·35	1	..	0·14	1	1	0·03	..	..	..	..	..	..

Group I—																			
Gonorrhœa	95	..	5·75	134	..	5·87	9	..	0·71	1	..	0·02	1	..	0·01	..	..	..
Syphilis	10	..	0·99	36	..	2·22	..	..	..	..	..	..	..	..	..	..	..	..
Soft chancre	4	..	0·35	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Totals	109	..	7·09	171	..	8·11	9	..	0·71	1	..	0·02	1	..	0·01	..	..	..
Intoxications—																			
Alcoholism	3	1	0·08	6	..	0·15	..	..	..	..	..	..	..	..	..	..	..	..
Totals	3	1	0·08	6	..	0·15	..	..	..	..	..	..	..	..	..	..	..	..
Effects of parasites—																			
Pediculus vestimenti	12	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Phthirius inguinalis	..	..	..	15	..	0·09	..	..	..	..	..	..	..	..	..	..	..	..
Ringworm	5	..	0·06	2	..	0·10	..	..	..	..	..	..	..	..	..	..	..	..
Tænia solium	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scabies	70	..	1·84	84	..	3·69	2	..	0·08	3	..	0·07	..	..	..	..	..	..
Oxyuris vermicularis	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	89	..	1·97	101	..	3·88	2	..	0·08	3	..	0·07	..	..	..	..	..	..
Other general diseases—																			
Debility	..	..	..	18	..	0·98	..	..	..	..	..	..	..	..	..	..	..	..
Anæmia	9	..	0·19	2	..	0·02	1	..	0·01	1	..	0·01	..	..	..	..	..	..
Anæmia (pernicious)	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gout	2	..	0·05	1	..	0·01	..	..	..	1	..	0·02	..	..	..	..	..	..
Obesity	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Osteo-arthritis	..	..	..	7	..	0·15	..	..	..	..	..	..	..	..	..	..	..	..
Fibroma	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Osteoma	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..
Papilloma	..	..	..	1	..	0·09	..	..	..	..	..	..	..	..	..	..	..	..
Carcinoma, jaw	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
Teratoma	..	..	..	1	..	0·07	..	..	..	..	..	..	..	..	..	..	..	..
Cyst	1	..	0·02	6	..	0·18	..	..	..	..	..	..	..	..	..	..	..	..
Endothelioma	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	14	..	0·30	39	1	1·55	1	..	0·01	2	..	0·03	..	..	..	..	..	..
Diseases of the Nervous System.																			
Neuritis	1	..	0·01	9	..	0·32	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of membrane of brain	1	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Apoplexy	..	..	..	2	3	0·91	..	..	..	..	..	..	..	..	..	..	..	..
Paralysis, local	1	..	0·02	..	..	..	..	..	..	1	..	0·02	..	..	..	..	..	..
Tremor	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

ABSTRACT OF TABLE 1, SHOWING THE ADMISSIONS INTO HOSPITALS, DEATHS, AND AVERAGE CONSTANTLY SICK AMONGST THE TROOPS IN THE VARIOUS CAMPS AND STATIONS FOR THE YEAR 1918—*continued*.

Diseases.	Featherston.			Trentham.			Narrow Neck.			Awapuni.			Hanmer.			Rotorua.		
	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.
Diseases of the Nervous System—continued.																		
Epilepsy	6	..	0·12	9	1	0·12	..	..	..	..	..	..	1	..	0·01	..	..	..
Vertigo	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..
Headache	..	..	..	5	..	0·13	..	..	..	1	..	0·02	..	..	..	..	..	..
Neuralgia	2	..	0·05	3	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..
Hysteria	..	..	..	9	..	0·19	..	..	..	1	..	0·05	..	..	..	..	..	..
Neurasthenia	7	..	0·11	7	..	0·24	..	..	..	..	..	..	3	..	0·12	..	..	..
Totals	19	..	0·39	45	4	1·08	..	..	..	3	..	0·09	4	..	0·13	..	..	..
Mental—																		
Idiocy	..	..	..	2	..	0·04	..	..	..	1	..	0·01	..	..	..	..	..	..
Mania	2	..	0·01	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..
Melancholia	1	..	0·02	2	..	0·05	..	..	..	1	..	0·01	..	..	..	..	..	..
Delusional insanity	1	..	0·02	2	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..
Totals	4	..	0·05	7	..	0·18	..	..	..	2	..	0·02	..	..	..	..	..	..
Diseases of the Eye.																		
Conjunctivitis	10	..	0·24	3	..	0·04	..	..	..	3	..	0·06	..	..	..	..	..	..
Keratitis	..	..	..	1	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..
Opacity of cornea	2	..	0·04	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..
Iritis	1	..	0·08	3	..	0·08	..	..	..	..	..	..	..	..	..	..	..	..
Neuralgia of eyeball	..	..	..	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of lachrymal gland	..	..	..	1	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..
Dacryo-cystitis	..	..	..	1	..	0·09	..	..	..	..	..	..	..	..	..	..	..	..
Totals	13	..	0·36	10	..	0·31	1	..	0·01	3	..	0·06	..	..	..	..	..	..
Diseases of the Ear.																		
Inflammation of external meatus	1	..	0·02	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of middle ear	5	..	0·18	3	..	0·13	1	..	0·02	..	..	..	2	..	0·03	..	..	..
Deafness	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Totals	6	..	0·20	5	..	0·17	1	..	0·02	..	..	..	2	..	0·03	..	..	..

Diseases of the Nose.																			
Inflammation of soft part of nose	2	..	0·05	7	..	0·21	..	..	..	..	..	..	..	..	..	..	..	..	..
Nasal deformity	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Epistaxis	1	..	0·01	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of accessory sinuses	1	..	0·02	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of naso-pharynx	7	..	0·15	2	..	0·07	..	..	..	1	..	0·1	..	..	..	..	..	..	..
Diseases of framework	..	..	..	5	..	0·16	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	12	..	0·24	16	..	0·46	..	..	..	1	..	0·01	..	..	..	..	..	..	..
Diseases of the Circulatory System.																			
Pericarditis	1	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Valvular disease	6	..	0·40	4	1	0·23	..	..	..	1	..	0·05	..	..	..	..	..	..	..
Angina pectoris	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Effects of strain (heart)	2	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Syncope	2	..	0·02	9	..	0·10	..	..	..	..	..	..	..	..	..	..	..	..	..
Disordered action of heart	12	..	0·28	25	1	1·09	..	..	..	6	..	0·21	..	..	..	..	..	..	..
Phlebitis of veins	2	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thrombosis of veins	1	..	0·08	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Varix	..	..	..	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..
Totals	27	..	0·92	38	2	1·42	..	..	..	8	..	0·27	..	..	..	..	..	..	..
Diseases of the Respiratory System.																			
Asthma	14	..	0·39	15	..	0·28	..	..	..	3	..	0·09	..	..	..	..	..	..	..
Inflammation of larynx	7	..	0·31	9	..	0·19	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulceration of larynx	..	..	..	3	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..	..
Perichondritis	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tracheitis	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bronchitis	18	..	0·61	34	..	1·44	11	..	0·25	6	..	0·05	1	..	0·02	..	..	..	..
Hæmorrhage of lung	4	..	0·13	3	..	0·21	..	..	..	..	..	..	..	..	..	..	..	..	..
Broncho-pneumonia	..	..	..	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..
Phthisis	3	..	0·04	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..
Pleurisy	16	1	0·54	15	..	0·70	..	..	..	4	..	0·08	..	..	..	6	..	0·41	
Empyema	2	..	0·17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Adhesions of pleura	3	..	0·13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Congestion of lung	..	..	..	1	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..	..
Paralysis of larynx	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chronic internal inflammation of lung	1	..	0·01	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	71	1	2·36	82	..	2·98	11	..	0·25	14	..	0·23	1	..	0·02	6	..	0·41	

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Diseases.	Featherston.			Trentham.			Narrow Neck.			Awapuni.			Hanmer.			Rotorua.		
	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.
Diseases of the Digestive System.																		
Ulceration of lips	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of mouth	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Ulceration of mouth	..	..	..	80	..	3·26	..	..	..	..	..	..	..	..	..	..	..	..
Disorders of dentition	1	..	0·02	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..	..
Suppuration of dental pulp	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..
Abscess of dental periost	1	..	0·01	3	..	0·21	..	..	..	..	..	..	1	..	0·01	..	..	..
Inflammation of periost and gums	1	..	0·02	14	..	0·49	..	..	..	1	..	0·01	..	..	..	..	..	..
Inflammation of jaw	..	..	..	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of pharynx	5	..	0·13	..	..	..	..	..	..	1	..	0·02	..	..	..	..	..	..
Inflammation of stomach	25	..	0·64	25	..	1·25	..	..	..	1	..	0·03	..	..	..	..	..	..
Hæmorrhage of stomach	1	..	0·03	1	..	0·19	..	..	..	..	..	..	..	..	..	..	..	..
Ulceration of stomach	13	..	0·49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Indigestion	8	..	0·21	48	..	1·84	..	..	..	5	..	0·18	..	..	..	..	..	..
Hyperchlorhydria	..	..	..	3	..	0·10	..	..	..	..	..	..	..	..	..	..	..	..
Vomiting	3	..	0·05	5	..	0·15	..	..	..	..	..	..	..	..	..	..	..	..
Gastralgia	2	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of intestines—																		
(1.) Enteritis	2	..	0·03	10	..	0·28	..	..	..	3	..	0·05	..	..	..	..	..	..
(2.) Appendicitis	24	..	0·61	3	..	0·57	..	..	..	3	..	0·05	..	..	..	1	..	0·02
(3.) Colitis	..	..	..	14	..	0·04	..	..	..	2	..	0·07	..	..	..	..	..	..
Hernia	1	..	0·01	2	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..
Diarrhœa	9	..	0·27	11	..	0·25	..	..	..	1	..	0·01	..	..	..	..	..	..
Constipation	1	..	0·01	7	..	0·12	..	..	..	..	..	..	..	..	..	..	..	..
Colic	8	..	0·10	11	..	0·23	..	..	..	..	..	..	..	..	..	..	..	..
Periproctitis	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fissure of anus	2	..	0·04	2	..	0·25	..	..	..	..	..	..	..	..	..	..	..	..
Fistula in anus	1	..	0·02	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..
Piles	11	..	0·14	13	..	0·42	..	..	..	1	..	0·01	..	..	..	..	..	..
Congestion of liver	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jaundice	2	..	0·16	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of peritoneum	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Adhesion of peritoneum	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aseites	..	..	..	..	..	0·24	..	..	..	..	..	..	..	..	..	..	..	..
Vincent's angina	..	..	..	16	..	0·83	..	..	..	2	..	0·02	..	..	..	..	..	..
Totals	126	..	3·12	273	..	10·90	..	..	..	21	..	0·46	1	..	0·01	1	..	0·02

Diseases of the Adrenals.																			
Inflammation of adrenals	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..
Totals	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..
Diseases of the Urinary System.																			
Nephritis (chronic)	..	..	..	..	..	..	..	..	..	..	..	..	1	..	0·01	..	..	..	..	..
Pyelitis	..	3	..	0·10	3	..	0·48	..	..	..	..	..	..	..	..	..	..	..	..	..
Cystic disease	..	6	..	0·13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of bladder	..	3	..	0·11	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..
Renal colic	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stricture of ureters	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Retention of urine	..	1	..	0·20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Incontinence of urine	..	9	..	0·21	11	..	0·35	1	..	0·01	..	..	..	..	..	..	..	..	..	..
Hæmaturia	..	3	..	0·13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Glycosuria	..	..	..	..	2	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..	..
Albuminuria	..	..	..	..	2	..	0·09	..	..	..	..	..	..	..	..	..	..	..	..	..
Irritability of bladder	..	..	..	..	3	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..	..
Diabetes	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	..	28	1	0·91	22	..	1·05	1	..	0·01	1	..	0·01	..	..	..	..	..	..	..
Diseases of the Generative System.																			
Oxalmia	..	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..
Gleet	..	5	..	0·20	6	..	0·31	..	..	..	..	..	..	..	..	..	..	..	..	..
Bacilluria	..	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Urethritis	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hæmorrhage of urethra	..	..	..	..	2	..	0·18	..	..	..	..	..	..	..	..	..	..	..	..	..
Stricture of urethra	..	..	..	..	3	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..
Phimosis	..	1	..	0·08	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of glands of penis	..	1	..	0·01	3	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..
Paraphimosis	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of spermatic cord	..	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..
Varicocele	..	..	..	..	2	..	0·08	..	..	..	..	..	..	..	..	..	..	..	..	..
Orchitis	..	7	..	0·28	..	..	..	2	..	0·06	..	..	..	..	..	..	..	..	..	..
Epididymitis	..	1	..	0·08	2	..	0·07	..	..	..	..	..	..	..	..	..	..	..	..	..
Spermatorrhœa	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hydrocele	..	..	..	..	..	..	..	1	..	0·04	..	..	..	..	..	..	..	..	..	..
Totals	..	18	..	0·71	22	..	0·78	3	..	0·10	..	..	..	..	..	..	..	..	..	..

ABSTRACT OF TABLE 1, SHOWING THE ADMISSIONS INTO HOSPITALS, DEATHS, AND AVERAGE CONSTANTLY SICK AMONGST THE TROOPS IN THE VARIOUS CAMPS AND STATIONS FOR THE YEAR 1918—*continued*.

Diseases.	Featherston.			Trentham.			Narrow Neck.			Awapuni.			Hanmer.			Rotorua.		
	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.	Admitted.	Died.	Average constantly Sick.
Diseases of the Organs of Locomotion.																		
Periostitis	1	..	0·02	8	..	0·37	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of joints	30	..	0·92	10	..	0·55	..	..	..	..	..	..	..	..	..	..	..	..
Relaxation of ligaments	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Psoas and other abscesses	2	..	0·11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of muscles	3	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Myalgia	19	..	0·62	50	..	1·79	4	..	0·26	2	..	0·06	..	..	..	..	..	..
Inflammation of fasciæ	..	..	..	22	..	0·95	..	..	..	..	..	..	..	..	..	..	..	..
Adhesion of tendons	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of sheaths of tendons	..	..	..	52	..	1·92	..	..	..	..	..	..	..	..	..	..	..	..
Ganglion	1	..	0·02	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Inflammation of bursæ	1	..	0·03	10	..	0·34	..	..	..	..	..	..	..	..	..	..	..	..
Bunion	1	..	0·06	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Flat feet	1	..	0·01	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Deformities of toes	2	..	0·02	4	..	0·23	..	..	..	..	..	..	..	..	..	..	..	..
Totals	63	..	1·88	159	..	6·21	4	..	0·26	2	..	0·06	..	..	..	..	..	..
Diseases of the Connective Tissue.																		
Hæmorrhage	1	..	0·04	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..
Œdema	1	..	0·02	2	..	0·02	..	..	..	1	..	0·01	..	..	..	..	..	..
Gangrene	1	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	3	..	0·09	3	..	0·03	..	..	..	1	..	0·01	..	..	..	..	..	..
Diseases of the Skin.																		
Erythema	..	..	..	3	..	0·04	..	..	..	1	..	0·01	..	..	..	..	..	..
Urticaria	2	..	0·03	2	..	0·02	1	..	..	..	..	..	..	..	..	..	..	..
Eczema	10	..	0·21	16	..	0·61	1	..	..	..	..	..	..	..	..	..	..	..
Impetigo	9	..	0·51	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Herpetiformis	..	..	..	5	..	0·21	..	..	..	..	..	..	..	..	..	..	..	..
Herpes	6	..	0·13	8	..	0·33	..	..	..	..	..	..	..	..	..	1	..	0·02
Shingles	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
Dermatitis herpetiformis	2	..	0·13	1	..	0·05	..	..	..	1	..	0·04	..	..	..	..	..	..

Psoriasis	2	..	0·09	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Seborrhœa	1	..	0·06	3	..	0·12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dermatitis seborrhœa	5	..	0·08	3	..	0·11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sebaceous cyst	1	..	0·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Acne	..	..	..	4	..	0·06	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Prickly heat	..	..	..	1	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Folliculitis sycocis	..	..	..	1	..	0·11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	38	..	1·28	49	..	1·72	2	..	..	2	..	0·05	..	..	..	1	..	0·02					
General Injuries.																							
Effects of heat (burns and scalds)	1	..	0·03	4	..	0·25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Effects of irritants and corrosives	..	..	..	1	..	0·08	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shock	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	1	..	0·03	6	..	0·34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Local Injuries.																							
Burns and scalds	..	..	..	1	..	0·07	1	..	0·12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Effects of irritants and corrosives	..	..	..	2	..	0·04	..	..	..	3	..	0·05	..	..	..	..	..	..	..	..	..	..	..
Abrasions	4	..	0·11	18	..	0·40	1	..	0·01	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..
Bruises and contusions	35	..	1·13	24	..	0·96	1	..	0·10	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..
Wounds	13	..	0·56	7	..	0·19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wounds, gunshot	1	..	0·02	15	..	0·87	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sprains and strains	68	..	2·34	142	..	4·75	2	..	0·11	4	..	0·21	1	..	0·04	3	..	0·10					
Displacements or dislocations	1	1	0·03	2	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rupture of soft parts	..	..	..	3	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fractures	10	..	0·53	24	..	1·99	..	..	..	2	..	0·25	..	..	..	..	..	..	..	..	..	..	..
Stretching of nerve	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Displacement of intra-articular cartilage	..	..	..	6	..	0·12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Concussion of brain	2	..	0·16	1	1	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Effects of foreign bodies	..	..	..	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Post-operation adhesions	..	..	..	1	..	0·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	134	1	4·88	247	1	9·60	5	..	0·34	11	..	0·53	1	..	0·04	3	..	0·10					
Effects of anti-typhoid vaccine	..	..	..	9	..	0·09	..	..	..	2	..	0·01	..	..	..	..	..	..	..	..	..	..	..
Poison (coal-gas)	1	..	0·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
No appreciable disease	4	..	0·05	35	..	0·47	..	..	..	2	..	0·03	..	..	..	..	..	..	..	..	..	..	..
Suicides	..	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Grand totals	5,674	174	148·63	4,931	94	165·12	493	17	18·52	360	7	8·10	56	3	1·92	64	..	1·70					

TABLE 2.—SHOWING THE AVERAGE STRENGTH, SICKNESS, AND DEATHS AMONGST OFFICERS DURING THE YEAR 1918.

Average strength, 316. Admissions, 113 (ratio per thousand, 358·0). Deaths 17 (ratio per thousand, 53·79).

Diseases.	Attacks of Illness.	Died.	Average Number constantly Sick.	Diseases.	Attacks of Illness.	Died.	Average Number constantly Sick.
General Diseases.				*Local Diseases.*			
Group A—				Nervous	1	..	0·02
Cerebro-spinal fever ..	1	1	0·01	Respiratory system ..	4	..	0·13
German measles ..	1	..	0·06	Digestive system ..	10	..	0·22
Measles	2	..	0·09	Urinary system ..	1	..	0·04
Influenza	70	15	2·24	Organs of locomotion ..	2	..	0·08
Group E—				Skin	3	..	0·16
Minor septic diseases ..	2	..	0·03	Injuries	9	..	0·19
Group G—							
Rheumatic fever ..	1	..	0·05				
Sore throat	2	..	0·07				
Tonsilitis	1	..	0·01				
Group H—							
Tubercle of lung ..	..	..	..				
Intoxicants	..	1	..				
Other general diseases ..	3	..	0·10	Totals ..	113	17	3·50

TABLE 3.—SHOWING AVERAGE STRENGTH, ADMISSIONS TO HOSPITAL, DEATHS, AND AVERAGE CONSTANTLY SICK, BY REINFORCEMENTS AND CORPS, FOR YEAR 1918.

Reinforcements or Corps.	Average Strength.	Admissions to Hospital.	Died.	Average constantly Sick.
N.Z. Mounted Rifles	607	433	13	9·72
N.Z. Field Artillery	475	505	14	12·04
N.Z. Engineers	113	89	2	2·54
34th Reinforcements	124	78	2	2·75
35th Reinforcements	209	116	..	3·42
36th Reinforcements	196	83	..	2·60
37th Reinforcements	236	116	..	3·50
38th Reinforcements	304	172	..	5·11
39th Reinforcements	260	81	..	2·55
40th Reinforcements	299	189	1	6·68
41st Reinforcements	246	151	..	6·34
42nd Reinforcements	129	85	..	4·68
43rd Reinforcements	312	511	..	11·05
44th Reinforcements	307	636	14	24·64
45th Reinforcements	283	820	9	29·27
46th Reinforcements	252	883	28	21·84
47th Reinforcements	190	673	14	16·63
48th Reinforcements	143	632	18	13·42
49th Reinforcements	120	618	12	17·42
50th Reinforcements	72	381	12	13·32
51st Reinforcements	26	102	9	2·48
52nd Reinforcements	21	76	1	1·70
53rd Reinforcements	16	68	3	2·02
54th Reinforcements	11	63	2	0·98
N.Z. Army Service Corps	215	130	10	3·56
N.Z. Medical Corps	751	717	20	18·33
N.Z. Dental Corps	74	50	4	1·26
N.Z. Army Pay Corps	16	12	1	0·28
Details	767	778	26	28·18
Maori Reinforcements	238	475	17	18·18
C1 Camp	849	1,048	24	30·28
Staff and departments	1,320	807	39	27·24
Totals	9,181	11,518	295	343·99

Approximate Cost of Paper.—Preparation, not given; printing (1,500 copies), £67 10s.

By Authority: MARCUS F. MARKS, Government Printer, Wellington.—1919.

Price 1s.]