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RESPIRATORY DISEASES

as affecting the  
NEW ZEALAND EXPEDITIONARY FORCES  
serving in France and United Kingdom

An analysis of the Histories  
of 2433 men  
Boarded as unfit for further Service

June 1916 to December 1918


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During the year 1918 I acted as Divisional Medical Officer at No.2. New Zealand General Hospital Walton-on-Thames Surrey.

A large number of the men referred to passed through that Hospital, and cases of Tubercle of the Lung were collected there for treatment pending evacuation to New Zealand.

Major E.W Colbeck NZ.MC. of 55 Upper Berkley St. London, as Specialist Officer, reviewed them, and clasification was made under his guidance.

Other men were Boarded as unfit for service at -


No.1 .N.Z.General Hospital (Brockenhurst)

No.3 .N.Z.General Hospital (Codford)

N.Z.Convalescent Hospital (Hornchurch)

Col. Macdonald, Consulting Medical Officer, NZ.MC. was the Specialist at these places.

The papers have been made available for me by the D.M.S. <sup>N.Z.E.F.</sup> whose consent I have to use them for the purpose of this Thesis.



RESPIRATORY DISEASES IN N.Z.E.F.

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General.

The accompanying paper refers to an analysis of 2433 histories of N.C.Os and men of the N.Z.E.F, Boarded and sent to New Zealand for various diseases of the Respiratory System. Diseases of the upper air passages are not included.

Those investigated were Boarded under the various headings as given below: -

- A. Tuberculous Pulmonary Disease.
  - 1. Positive.
  - 2. Clinical.
- B. Chronic Pulmonary Disease - Indeterminate.
- C. Fibrosis.Ch.Interstit.Pneu, - non-Tuberc.
- D. Pleurisy:
  - 1. Without effusion.
  - 2. With marked effusion.
- E. Empyema.
- F. Broncho.Pneumonia.
- G. Pneumonia.Lobar
- H. Bronchitis.
- I. Asthma.
- K. Emphysema.

These Boards date from June 1916 to December 1918 (inclusive), covering a period of 31 months at the latter end of the War. Numbers previous to this are not available.

During the period there were 5188 admissions to Hospital in U.K. for Respiratory Diseases.

The average number of men of the N.Z.E.F. during this period was 45,000.

Number of men Boarded 2433.

Percentage of men Boarded to total admissions to Hospital - 46%.



These Tables shew : -

1. Number of men admitted to Hospital in U.K., compared with totals Boarded.
2. Boarded men, with numbers giving histories of disease pre-war and during war.

1. Admitted to Hospital and Boarded

Pos.	<u>To Hospital</u>	<u>Boarded</u>
T.B.	-	207
Clin.	-	643
CPDI	-	277
Fibrosis	10	50
Pleurisy	882	248
Empyema	18	37
Haemoptysis	10	-
Er. Pneum.	227	41
Pneum.	779	123
Bronchitis	2285	591
Asthma	163	169
Emphysema	22	47
Sore throat & Tonsillitis	792	-
	<u>5188</u>	<u>2433</u>

2. Tally of Boards.

Pos.	<u>Chest disease pre-war</u>	<u>Illness during war</u>	<u>Not different'd</u>	
T.B.	40	167	-	..207
Clin.	63	137	443	..643
CPDI	63	214	-	..277
Fibrosis	37	13	-	...50
Pleurisy	-	-	119	..248
Pleurisy c effusion	-	-	129	
Empyema	-	-	37	...37
Br. Pneum.	-	-	41	...41
Pneumonia	-	-	123	..123
Bronchitis	280	311	-	..591
Asthma	149	20	-	..169
Emphysema	34	13	-	...47
	<u>666</u>	<u>825</u>	<u>892</u>	<u>2433</u>





The Respiratory affections here recorded presumably occurred among an A class group of men, but the many difficulties in the way of examination before enlistment made it certain that a percentage of unfit men would get into the ranks, and the histories shew that a number who broke down were not well chosen.

The incidence of disease among our New Zealand soldiers, who are brought on a long sea voyage, and often landed in England in a winter climate much more severe than they are accustomed to, is more pronounced in the respiratory affections than in other diseases.

In many of the transports the greatest care did not obviate the outbreak of measles, and our men shewed a general average of severe bronchial trouble. Epidemics of Influenza also caused grave respiratory symptoms.

In our base camps these outbreaks were always a cause of anxiety to those in charge, the newly landed soldier in particular developing severe broncho-pulmonary symptoms. As a rule, in the opinion of Imperial Medical Officers, these complications were much more severe than in the case of men of the Home Forces.

These epidemics and the frequency of winter catarrh among our Forces, were main factors in the development of persistent bronchial and throat troubles, which were got rid of with difficulty in the winter months. In consequence many were susceptible to fresh infection under the hard conditions in the trenches.

Overcrowding in transports, in hutments, and in Hospitals, made all our acute respiratory affections much more widespread. Where it was possible to provide plenty airspace for the young soldier while he developed his immunity, epidemic catarrhal disease was greatly lessened.



As our soldiers became inured to new climatic conditions, and recovered from their early catarrhal infection, they developed better powers of resistance, and in time there was little difference between our men and those of the Home Forces.

Eyre and Lowe have published the result of their investigations as to the degree of actual immunity among New Zealand soldiers, in connection with prophylactic vaccinations undertaken to protect from these epidemics. Their conclusions were -

- " 1. That the average colonial just arrived in England, has only about 50% of the natural immunity to the organisms of catarrh prevalent in England that the average English soldier enjoys.
- 2. That as the result of catarrhal vaccinations his immunity can be considerably increased; and
- 3. That, at any rate, for a time, his specific agglutinin to catarrhal organisms exceed in amount those of the average Englishman."

Lancet 10th Oct. 1918

The enthusiasm of Captain Lowe N.Z.M.C, Pathologist at No. 2. N.Z. General Hospital Walton-on-Thames, in developing the mixed catarrhal vaccine (M.C.V.) brought good results. There is much evidence to shew that its universal use and repetition among our men saved many lives, and undoubtedly prevented the later development of the Respiratory (affective) affections which are the subject of this report. This opinion is held by the greater number of Medical Officers who had to deal with these cases.

Serum of 20 N.Z. soldiers shewing agglutinins present  
A. Before Inoc. B. After Inoc.

C. Serum of 10 English soldiers shewing agglutinins

Organism	A. %	B. %	C. %
Pneumococcus	20	85	30
Streptococcus longus	10	75	30
B. Influenzae	20	95	50
Staph. aureus	90	100	90
Micro-cabarrhalis	40	85	40
B. Pneumoniae	-	40	60
B. Septus	15	80	40



### Tubercle Of the Lung

The number of cases under this head has been high - 850 - returned according to whether the T.B. was demonstrated in the sputum or not; as -

Positive	207	<del>643</del> 850
Clinical	643	

This gives percentage rates to total admissions to Hospital, and to numbers actually Boarded, as follows: -

		Admitted 5188	Boarded 2433
T.B pos.	207	3.7%	8.5%
T.B.Clin.	643	12.3%	26.4%
CPDI.	277	5.3%	11.3%

Percentage of Boarded men to total admissions - 46.

### Positive Tubercle

There are no figures yet available as to incidence of Positive Tubercle of the Lung in the British Army under War conditions. War Office figures are not yet completed, but it is stated that there is probably no great increase above pre-war rates.

The latest statistical return is for 1913. A comparison with this is not a method to give true relations at present. It gives a standard of a sort, and some facts can be elicited.

Further comparisons as regards Respiratory Diseases as a whole do not give information of value under the greatly altered circumstances. But from the above it is shewn that our incidence of Tubercle of the Lung is practically the same as that of the British Regular Army on a peace footing.

This is distinctly good for Positive Tubercle, and should place us in a favourable position when statistics are available of other Forces.

Consideration may be given to the fact in our statistics, that the date from which papers are available was long after the war started. Many of the men had felt its hardships, and, except for reinforcements, it was not a new force. The inclusion of former figures would have been interesting,



but they were unfortunately destroyed at sea by enemy action. In the War Office returns for 1917, the figures for 1913 are given with reference to Troops in the United Kingdom - pages 155 and 170 : Respiratory Disease - Group H. - Tubercle of Lung.

English. Strength over 100000 -  
Men in United Kingdom only.

	Totals per annum	Ratio per 1000 of strength
Invalidings	155	1.46
Deaths	25	.31

Invalidings for Home and Foreign Troops - 1.3 (Returns -Chart 11)

New Zealand. Strength 45000

(1) Whole force.

	Totals per annum	Ratio per 1000 of strength
Invalidings	80	1.77
Deaths	13	.29

(2) Less Maoris - (1200) strength = 43800

	Totals per annum	Ratio per 1000 of strength
Invalidings (180)	70	1.58
Deaths (24)	9.3	.2





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Tubercle Of the Lung (Clinical) 643 cases.

This forms the largest group Boarded for Respiratory affections among the N.Z.E.F. Clinically they were similar to the Positive cases, but even where the physical signs were most typical of Tubercular infection, repeated sputum examinations failed to prove the presence of the Bacillus. The diagnosis was much more freely made than in the Imperial Forces, and it is due to this group that our returns compare unfavourably with theirs.

The usual careful examinations before enlistment, during training in N.Z., and on arrival in England, did not reveal this weakness. In fact the men as a body were comparable physically to any forces employed during the War.

It is not easy to determine how <sup>far</sup> our population is infected with Tuberculous disease. In the light of present day investigation, where the almost universal infection in childhood is demonstrated, it is certain that a fair percentage of our men had healed tubercular lesions. But these lesions were not demonstrable as gross lung change in the recruit. There would undoubtedly be some with glandular foci in the quiescent state; and the view that the signs and symptoms which justified a diagnosis of tuberculous infection of the lungs depended on the "lighting up", under conditions of military service, of old healed foci in the lungs must be given due consideration.

Investigation shews that some of the men who broke down, had a history of Pre-War chronic respiratory trouble, others had a history of haemoptysis, and a few had been in sanatoriums. In others there was a definite history of



Lung Tubercle in the family - parents, brothers or sisters.

In defence of the inclusion of these, it is to be remembered that all who have shewn active tubercular lesions do not break down during service, the result depending much on the hardships to which they may be exposed. But the majority do succumb after a longer or shorter interval, and are invalided.

After a period of service the question whether invaliding is "aggravated by" or "due to" active service conditions does not relieve the country of paying their pensions. On this point it may be stated that pulmonary tuberculosis can be considered attributable to military service when active signs appear for the first time at a date three months or more beyond the time of enlisting. During this probationary period, there should be time to find those men who have the infection, and have not been detected before enlistment.

Under the hurried methods indispensably associated with War conditions, the necessary exact tests were not available, and the keenness of many young soldiers for enlistment made them reticent as to matters of personal and family history.

To the War itself must be attributed the larger proportion of cases of phthisis with which we have to deal. Besides the cases in which latent tubercular lesions are aroused under the strain of War through diminished vitality in the soldier, there is no doubt a large class of cases in which direct infection plays a part. The unavoidable overcrowding in billets and huts must have presented many opportunities for massive infection and danger when a case of phthisis has developed under such conditions.



Early Diagnosis. There have been the usual difficulties in determining whether cases should be included under the heading of Clinical Tubercle of the Lung.

Early diagnosis, when once the signs of pulmonary infection begin to manifest themselves, is indispensable if we are to obtain the best results of treatment, and prevent the spread of infection. The insidious onset in so many of the cases, well demonstrated among our men, has made early diagnoses under active service conditions by no means easy.

During the earlier months returns were rendered under the two headings "Positive" and "Clinical" Tubercle of the Lung. The Clinical type were the greater number (643). Many of the men did not shew great impairment of the lungs, and in a large proportion of those Boarded and sent to New Zealand, the physical signs cleared remarkably during the voyage. On arrival, they were stated to shew no disability, and they returned physically fit to their usual avocations, though their recovery had not progressed in U.K, and few would have been ultimately fit for service. These were cases, as a rule, with pneumonic exudation and peribronchial catarrhal conditions which were very slow in clearing up, and gave persistent apical signs.

It was felt that the stigma of Tubercle attached to these cases might be avoided, and the classification made easier for examining officers, by instituting a separate class in which there could be included cases under suspicion, but in which a hopeful prognosis might be given.

It was directed that men should be included who were not shewing advanced lesions, - where there was dullness at one or more apices, particularly on one side, with no marked adventitia, and where the condition had not cleared in about three months. These were classed as Chronic Pulmonary





Disease Indeterminate (C.P.D.I.). "Indeterminate" cases were sent home with much the same precautions as those who were diagnosed as "T.B.", and no risks were taken of spreading possible infection.

The use of this third grade proved of practical value during the later months of the War, and providing a means of separating the less suspicious cases, including those in which the impairment was possibly due to a healed tubercular focus.

In examining the Board Papers of the T.B. and Indeterminate cases, an effort has been made to tabulate the findings under available headings: -

1. Family History of Tubercle.  
Statements of "weak chest" etc in the Family have not been taken. These numbers should therefore be probably greater.
2. Disease in Soldier. - pre-war and during war  
Cases of chronic "weak chest" are given as well as Bronchitis and Pneumonia.
3. The number of cases in which the disease has followed an acute onset, - Bronchitis, Pleurisy, or Pneumonia, is considerable, the numbers being shewn in the Tables.
4. The occurrence of Haemoptysis has been noted as pre-war, during war, or during present acute onset.
5. The Physical Condition in the majority was good. Many had lost weight, and the fact has been taken into consideration with the general appearance in classifying.  
No accurate statement of loss of weight can be given for the class, as previous weights as given are very much uncertified.
6. An estimate has been made shewing the R. or L. side affected, for comparisons in the various sections, the R. side being considerably more involved, especially among the C.P.D.I.
7. Tables of "Age Incidence" and "Occupation" are also attached in the general Table for all Respiratory diseases.

These returns are subject to usual fallacies as regards "statements" by the soldier etc, but the papers give evidence of care in preparation, and as far as possible the fallacies are avoided.





T.B. and CPDI comparisons - 3.

	<u>T.B.Pos.</u>	<u>T.B.Clin.</u>	<u>CPDI</u>
No. of papers examined	207	200	277
<hr/>			
Family History			
Pos. T.B.	29 - 14.5%	45 - 22.5%	29 - 10.5%
Pre-War Disease			
Chr. Catarrh or Bronchitis	23	36	42
Pleurisy or Pneumonia	13	21	20
Old Tubercle	4	6	1
	<u>40</u> - 19%	<u>63</u> - 31.5%	<u>61</u> - 22 %
Disease during War			
Chr. Catarrh or Bronchitis	8	24	55
P.U.O. or Influenza	8	5	14
Pleurisy or Pneu.	4	15	22
	<u>20</u> - 9.5%	<u>44</u> - 22 %	<u>91</u> - 33 %
Onset Acute			
Bronchitis	16	23	30
P.U.O. or Influenza	7	1	23
Pleurisy or Pneu.	42	54	67
	<u>65</u> - 31.5%	<u>78</u> - 39 %	<u>120</u> - 43.5%
c. effusion	14 - 33 %	22 <sup>m</sup> - 40 %	18 - 27 %
Haemoptysis			
Pre-War	10 - 4.8%	11 - 5.5%	4 - 1.4%
During War	20 - 9.6%	15 - 7.5%	13 - 4.7%
Onset	36 - 17.1%	26 - 13 %	17 - 6.2%
	<u>66</u> - 31.5%	<u>52</u> - 26 %	<u>34</u> - 12.3%
<u>Gassing</u>	13 - 6.3%	19 - 9.5%	33 - 12 %

200 only of 643 Clinical cases were analysed for percentage comparison.

The Relative total number of acute onset (Pleurisy and Pneumonia) for 643 cases is 173.



TABLE 3

Shows comparisons between cases diagnosed Tubercle of the Lung (Pos. and Clin.) and C.P.D.I.

1. Family History. The incidence of Tubercle is greater in the Clinical cases 22%, than in either of the other classes.  
C.P.D.I. 10.5%, is lower than Positive 14.5%.
2. a. Pre-war disease is greatest in the Clinical type 31.5%.  
C.P.D.I. 22%, and Positive 19%, do not shew much difference.  
A total of 11 cases give histories of known T.B.
- b. Illness during service. These figures are, as far as possible, a record of cases which were more or less acutely ill at some period, necessitating treatment.  
C.P.D.I. 33%, gives the highest incidence.  
Clinical 22%; Positive 9.5% has a very low rate here.
3. a. Acute Onset. Where there was acute onset, -as Bronchitis, P.U.O, Pneumonia, the figures are: -  
Positive 31.5%, Clinical 39%, C.P.D.I. 43.5%.  
Where the onset began with Pleurisy, there was effusion in a large percentage. Positive 33%, Clinical 40%, CPDI 27%.
- b. Insidious Onset. The numbers of cases in which these soldiers suffered during service from "constant cold and cough" with dyspnoea, is very great. This has been the most constant combination. Most of them carried on, and the symptoms increased gradually in a sub-acute form, the history of illness varying from one month to several months, before arrival in Hospital.  
The larger number of Positive Tubercular cases arose in an insidious manner, -the acute affections not being so pronounced as in the other two classes, and particularly so in relation to sickness during service.
4. Haemoptysis. The occurrence of Haemoptysis in the three periods is as would be expected, -Positive cases shewing



the greatest incidence in each, and CPDI the least.

5. General physical condition. The numbers returned in which there was marked disability, are only half those in which the general condition was good.

	<u>Pos.</u>	<u>Clin.</u>	<u>CPDI.</u>	<u>Total</u>
Fair to Normal	132	127	198	457
Poor	75	73	79	227

The ratios for T.B. (Positive and Clinical) are the same 1.75, and in the CPDI the ratio is 2.5. The CPDI as a class improved faster than the others, but it was no great diagnostic feature as the latter in the majority of cases made good progress under treatment in the open air.

Gastric disturbance varied. Some patients in all classes had poor digestive powers. There is not much in the histories to indicate that this factor gave much trouble; and previous to admission to Hospital, there is little record of ill health in this respect.

Chronic Pulmonary Disease - Indeterminate. 277 cases.

The very large numbers of patients in our Hospitals under treatment for chronic chest symptoms suspicious of Tuberculosis infection of the lung, has been a cause of grave concern to all medical officers, and to those in authority over them. The question of how to class the men was particularly important in an overseas force, where the sick had to be evacuated so long a distance as with the N.Z.E.F. They did not become fit for service in England, and were overfilling Hospital accommodation. It was thus necessary to evacuate them. All the classical signs and symptoms were present among these men *as in* —



as in the two groups diagnosed tuberculous.

Apart from the cases in which doubt arose in the slow clearing up of the lungs after an acute affection, there were others in which the men complained of lassitude, pain in the chest, cough with more or less sputum, and dyspnoea. There was some abnormal range of temperature, and a fast pulse rate was pronounced in nearly all. Sweating, more especially in bed, was noted in several instances. The symptomatic evidence pointed to toxæmia of some kind.

Haemoptysis did not occur among the latter group; the physical condition as a rule was good; though much under weight (i.e. from 14 to 28 lbs), improvement was marked after treatment. Most of the cases under suspicion gave positive findings to the common catarrhal organisms; and the chest cleared rapidly with the use of vaccines in a fair percentage. Repeated examinations did not reveal the presence of the Tubercle Bacillus.

Dullness on percussion with weak breathing at one apex or extending more or less to the base of the lung, were the common findings. In some there were moist sounds not confined to any particular area, but more marked at affected apex.

A considerable number of these cases were X Rayed, and in 12 instances there was a report that there was some fibrosis, but this change was not clearly defined.

Press of work made it impossible to view more of them.

The whole range of signs and symptoms is a matter of degree in the three classes.

There are cases of Positive T.B. with no more apical impairment than occurs among the CPDI.

Sputum Examinations were very freely and thoroughly made, Cases of CPDI were repeatedly tested, and the large amount of information obtained has been reviewed by Captain Lowe at No. 2 New Zealand General Hospital Walton-on-Thames, in whose





laboratory very valuable work was done.

The ordinary smears were in many instances verified by the antiform method, and guinea pig injections were also undertaken.

The average of positive findings after prolonged search, including the three Hospitals under management of the N.Z.E.F., was 5% of the sputa referred for suspicious catarrhal conditions.

In the Convalescent Hospital, the average was .9%.

CPDI (226 cases) gave 5%, and this is about equal to the above general group, which included all examinations of respiratory cases whether obviously phthisical, or simply catarrhal or influenzal.

Tubercular Disease (Clinical) : one group of 82 cases gave 14% positive

All groups shew comparatively small numbers of T.B. positive.

Other Pathological organisms than T.B., common in the respiratory tract, were present in gross numbers in many cases, which were sent for frequent examination because of questionable physical signs.

The catarrhal organisms commonly found in large number were Pneumococci, Micro-catarrhalis, and Staphylococci, (particularly S. aureus).

Streptococci were found in connection with B. Influenza and Pneumococci or Micro-catarrhalis.

B. Friedlander and Diphtheroids, though seldom found, were sometimes in such pure culture, as to suggest them as the cause of the catarrh.

The common success of vaccine where this group of organisms was found alone, suggests that subacute ~~and~~ catarrhal infections may very closely simulate the physical signs and symptoms of T.B. infection.



The use of vaccines cleared conditions that were simply catarrhal, and improved those in which T.B. had already commenced by removing the toxæmia of catarrhal infection, and also prevented chance of T.B. implanting itself on tissues damaged by the catarrhal process.

In mixed Streptococcal infections, repeated examination shewed that while the associated organisms quickly altered, the Streptococcus disappeared very slowly.

Vaccines were made in varying proportions from local strains of organisms to suit the findings of the case. Others were treated with an autogenous vaccine: and that in use was varied as the flora of the sputum changed.

Other Infectious Disease is not frequent in the histories. Among the T.B. and CPDI classes taken together, Dysentery occurs 10 times, Enteric Fever 6, recent Measles 8: and one man had had Cerebro Spinal Fever.

Influenza was the cause of invaliding in more of the Bronchitis cases than in any other.

Clinical Dysentery is not uncommonly given among the Bronchitis cases particularly, many of the men being old soldiers of Gallipoli and Egyptian campaigns who had recovered.

Other cases of Enteric are rare, Measles had affected a large percentage of the men.

Trench Fever is seldom mentioned under any Respiratory disease. Malaria was infrequent.

Syphilis was a serious complication in one case - a Maori - who died.



During the early months of 1918, a violent outbreak of purulent bronchitis among New Zealand troops at Sling camp occurred as a complication of Measles and Rubella.

Between January<sup>14</sup> and March 8th, there were 418 cases.

The infection broke out on troopships 14 days after leaving an American port, previous to which date the troops were healthy.

75 men developed true septicaemic bronchitis, and 26 died. All had copious muco-purulent bronchorrhoea, and the bacteriology of the sputum was identical. The deathrate was 7% of all cases with multiple infection.

In the severe type the respiratory complications ranged from bronchial catarrh to basal congestion, or lobar Pneumonia. The fatal ending was due to toxaemia, rather than lung impairment, as observed at autopsy.

Of 401 cases of febrile respiratory affections in other men associated with the former, 303 were diagnosed "clinical influenza". But only the men with Measles or Rubella developed purulent bronchitis: in them a streptococcal infection was pronounced in association with B. Influenzae. Other catarrhal organisms were present in lesser numbers.

The pneumococcus was abundant in two cases where the streptococcus was not found; this preponderance of the streptococcus has been common among the severe cases in New Zealand soldiers.

In October 1918 Epidemic Influenza appeared in severe form. The type with toxaemia, collapse, and heliotrope cyanosis occurred, as it had in cases complicating the exanthemata, but only a few developed purulent bronchitis.

During September 1918 many cases occurred on a transport, badly infected with a fatal septicaemic influenzal pneumonia at an African port.



The question of how far Influenza infection or Gassing had an influence in developing apical impairment under war conditions is hard to determine.

Results of Influenza.The various epidemics of Influenza affecting our troops have formed the subject of a special detailed report by Col. Macdonald, consulting physician to N.Z.E.F.

Eyre and Lowe have given particulars from the Pathological aspect ("Report on the Autumn Influenza Epidemic as it affected the N.Z.E.F. in the United Kingdom" Lancet 5th April 1918)

Considering the severity of this disease, and its very wide spread, it was to be expected that our men Boarded for Respiratory diseases would have shewn a frequent history of precedent Influenza. But this is not found to be the case. Probably a larger proportion admitted for acute Respiratory troubles, was caused by Influenza than stated in the Case Sheets; but even allowing for this, it appears that the majority of severe Influenza cases made a good recovery. And this is undoubtedly the experience of those Medical Officers who had charge of the men.

Our returns shew that more Influenza is associated with CPDI, than with T.B. classes.

Results of Gassing. No accurate estimate of the effects of Gassing can be made from our histories. All of the men were subjected to its influence more or less, and many did not take much notice of what seemed to others a severe ordeal. Inquiry shews that the Positive cases gave a history of 6.5%, Clinical 9.5%, and CPDI 12%. So that the average increases in the classes in which the presence of Tubercle becomes less probable.





Previous to the War, the effects of gas poisoning were unknown, and the conditions which might arise in the lungs as the result of smaller doses, are not yet closely defined.

The primary acute conditions caused by severe gas poisoning is followed by secondary symptoms in the respiratory system, - as diffuse bronchitis and emphysema, with general debility, pallor, dyspnoea, and chest pain, associated with fast pulse and other cardiac trouble.

It is probable that the lesser degrees of gassing might set up the slower catarrhal changes which give rise to so much doubt as to the nature of the lesion in cases suspected of Tubercle of the Lung. The irritation by gas inhalation of the delicate lung tissue, apart from gross lesions, would give catarrhal organisms a chance to become dominant; and in cases of catarrh already established, make the condition worse.

The several reports of the Medical Research Committee on gas poisoning in men and animals, refer only to the acute condition and the chronic after effects, while there is no reference to the effects of repeated lighter doses.

Diagnosis. The peculiar hardships due to the War conditions have caused the number of cases presenting anomalous signs in pulmonary conditions to become so conspicuous that the matter of diagnosis will require careful reviewing before determining what are the lesions certainly due to Tubercular infection. As in cardiac affections the manifestations of disease have appeared, under changed circumstances, in unfamiliar guise.

The question as to whether the diagnosis of Clinical Tubercle was justified in so many of our men, is open to discussion. It would appear that the diagnosis was too freely made in the earlier months; though the fact that there was recovery in most does not prove that they were not an early phase of Tuberculosis.




symptoms did not differ materially in the cases of greater or lesser degree, and the 5% which developed T.B. in the sputum during observation were not those who would have been picked out as most likely to become positive on Clinical grounds. Nor was there any relation in this to the physical signs.

In giving a prognosis it can be asserted that symptoms are of the greater import. The lung impairment was often slow in clearing; while the improvement in weight and general clearance of toxæmic symptoms, gave a true indication of improvement.

Ratios per 1000 per annum to total strength are given in the following Table for various groups of Respiratory diseases. Clinical T.B. is distinguished according to the periods when used alone and with CPDI.

	Total Invaliding	Ratio
T.B. Clin. 22 mos.	409	5
9 mos.	234	7
CPDI.	277	8.2
Average T.B. Clinical and CPDI 9 mos.		7.6
Pneumonia 31 months	123	1.06
x Pneum. Br. Pneum. Pleur. (inclu. T.B. Clin. & CPDI with onset of this type)	694	6
Asthma	169	1.45
Bronchitis	591	5
Admissions	5188	44.6
Invalidings	2433	20.9

x Including relative Total number Clinical T.B. - 173  
(see footnote Table 3.)

  
Other Respiratory Diseases

Other Respiratory diseases presented no striking types, and the main features of each are given below.

The tests for Tubercle were carried through the series to a greater or less extent, as occasion demanded.

Cases of Pleurisy, Pneumonia, or Broncho-Pneumonia in which the chests gave persistent apical impairment were included in the Clinical T.B. (173), and CPDI (67), and 42 gave positive T.B. results - 282 cases. These together with the cases returned under the above ~~three~~ categories, make a group of 694 cases. See page 20.

The Seasonal Incidence of Bronchitis is more marked than in other groups. Cases returned Asthma also shew a rise during the winter months. Bronch-Pneumonia shews this winter rise, but in Pleurisy and Pneumonia it is not so regularly defined.

*Table 8. p. 32.*

Deaths. During the period under review, the number of deaths among men of the N.Z.E.F. for Respiratory diseases not certified as due to Influenza or Measles is <sup>as</sup> under -

Pneumonia	58 (2 Maoris)	
Br. Pneumonia	19	
Bronchitis	5	
Pleurisy	7	
Tubercle of Lung	34 (10 Maoris)	- 123

There were also 63 deaths due to Pneumonia and Broncho-Pneumonia during Influenza epidemics, and 12 due to Measles, Many of these cases being of the septic broncho-pneumonia type.

	Total	Ratio per 1000 p.a.
Not complications of Influenza etc.	123	1.06
Including these 75	198	1.7





Pleurisy. 248 cases

Of these there were: -

Fibrinous	119	
With marked effusion	129	-248

Many of the cases with effusion were sent to N.Z. before the fluid had absorbed; the majority were Boarded for Debility with loss of weight, and cough with sputum.

Repeated tests were made for the presence of T.B. but in none of this series was it demonstrated.

In 31 there was a history of a previous attack.

The Table shews that the younger men were more liable to pleural effusion than those of older age.

Broncho-Pneumonia 41 cases

All these have had an acute illness of severe type. Their recovery is more or less complete: papers shew them to be suffering from debility, with physical signs disappearing satisfactorily with few exceptions.

History of "Influenza" is given in only one instance.

In two only is there stated to have been preceeding chronic chest disease.

In two there is "phthisis" among relations.

Pneumonia (Lobar) 123 cases

123 cases of Lobar type were sent to N.Z: 16 were stated to be unresolved: they were evacuated by Hospital Ship at an early stage when opportunity offered, as cot cases.

56 were suffering from debility, and the remainder were making satisfactory progress, the lungs clear, or nearly so, in most cases.

In 7 there was a history of an attack pre-war.

Empyema 37 cases

These were all drained. Some of them were evacuated with drainage still necessary. On the whole the cases were clearing well.

27 cases were admitted to Hospital as pleuro-pneumonia, and 10 as pleurisy with effusion.





Fibrosis 50 cases  
This includes cases of chronic Interstitial Pneumonia, in some of which there is adherent pleura or bronchiectasis.

In the greater number (37), there was chronic disease antecedent to the War, only 13 being stated as due to war service, and the former group includes men of more advanced age than the latter.

Bronchitis 591 cases  
Out of 5188 cases sent to Hospital in U.K., 2285 were originally diagnosed as Bronchitis, and 591 Boarded as chronic and discharged to N.Z. The large number admitted to Hospital under this head was mainly due to epidemics of Measles and Influenza, the majority being discharged to duty.

A proportion developed T.B. or were Boarded under CPDI, or other resulting diseases.

In 84 there was accompanying disability, - 38 markedly emphysematous, and 46 "Asthma", the latter as a rule being dyspnoeic conditions due to the Bronchitis.

Emphysema 47 cases  
Most of these cases occurred in the older men, 34 give a pre-war history of chronic cough and dyspnoea, and 13 are stated to have followed some respiratory affection during the war.

Asthma 169 cases  
These have a history of true Bronchial Asthma. 149 had asthmatic attacks pre-war, and only 20 state that they had no illness of this nature pre-war. Analysis of the latter shews that most of them developed spasmodic asthmatic attacks soon after entering camp, and it is probable that they had this diathesis.

The history in many of the cases under this heading gives asthma among the family.

The age incidence is higher than in the acute Pulmonary conditions.



In a class such as this it is interesting to note the length of service of the men. The dates taken were from Enlistment to Boarding, which gave an average period for all.

The majority had employment on Base jobs, and though they apparently had a fair length of service they form a class that was not worth enlisting.

		Date of first attack	
		Pre-war	During war
		%	%
Months	6	5	5
	9	14	-
	12	29	30
	18	24	-
Years	2	18	30
	3	9	35
	4	1	-

#### 4. Incidence on Right and Left Sides

	<u>Right</u>	<u>Left</u>	<u>Both</u>	
Pos.	84	58	65	.....207
T.B.				
Clin.	92	56	52	.....200
CPDI	146	43	88	.....277
Pneumonia	58	38	27	.....123
Pleurisy	52	60	7	.....119
Pleurisy c effusion	62	64	3	.....129
Empyema	27	10	-	.....37



Maori Soldiers

The fact that the native race is particularly prone to Tubercular disease of the lung, is shewn in the comparative numbers returned under this heading and CPDI.

The numbers Boarded in the Maori Pioneer Battalion, a force kept at an average strength of 1200, are as follows: -

	<u>1200 Maoris</u>	<u>45000 Whites</u>
Pos.	27	180
T.B. Clin.	66	577
CPDI	18	259

A percentage of Maoris served in other Battalions, but their numbers are not available, and are so small as not to affect returns.

In addition to the above cases, between June 1916 and December 1918, the period under review, there were ten deaths among Maoris in Hospitals in U.K. due to Tubercle of the lung. The total for the whole N.Z. Force was 33 for the same period, shewing a very high death rate among the Maoris.

Other Respiratory diseases among the Maori Pioneer Bat

Bronchitis	23	
Pneumonia	8	
Pleurisy	8	(c effusion - 6)
Empyema	3	
Fibrosis	2	
Asthma	1	
Emphysema	1	

Other Tuberculous diseases in the Maori Pioneer

Battalion were common. There were many cases of Peritonitis, Meningitis, and anal fistula of Tuberculous origin. Suppurating glandular conditions, which seldom occurred in the white soldier were very common among the Maoris.



### Occupations.

Analysis of the occupations of our men in relation to Incidence of disease, shows a large preponderance in actual numbers of the Farming and Labouring - outdoor working - classes. The Force being drawn from an agricultural population, it follows that the outdoor worker is in greater numbers than the indoor.

The Tables shew (5) the occupational incidence of the various diseases divided under main sub.heads, and and (7) the percentage compared with the components of the whole N.Z.E.F.

The proportions of each class in the N.Z.E.F. have been taken from the average of some hundreds of g.s.w.cases, which average would be about that in the forces as a whole.

This result gives:-

<u>Outdoor Workers</u>		
Farmers and Farm Labourers	40	
Genl.Labourers and Tradesmen	27	
Miners	3	- - 70%
<u>Indoor Workers</u>		
Clerks	18	
Other Sedentary	12	- - 30%

The percentages in T.B. and CPDI are practically in the same ratio as in the estimated average. *Table 7.*

Pleurisy, Pneumonia, and Bronchitis are more prominent in the outdoor class: and Asthma is also over the average here.

The Indoor class has the better position all round. But in this matter it is to be remembered that the New Zealand people as a whole are not confined in big cities, the indoor work of the average man is a mild affair compared with what it is in some countries, and there is not much difference in the physique and general health of the two classes.



5. OCCUPATIONS

	T.B.	CPDI.	Fibros.	Pleur.	c effus.	Pleur.	Emphy.	Br. Pneu.	Pneum.	Bronch.	Asthma.	Emphys.
	30	29	4	9	15	9	3	5	8	44	12	2
	23	25	4	16	9	2	2	2	12	57	23	4
	18	6	-	1	1	2	-	-	1	12	5	1
	3	9	-	1	4	-	-	-	1	3	-	-
	6	4	-	2	-	-	-	-	-	2	-	1
	1	4	-	45	53	14	14	14	50	179	50	18
	47	94	15	4	12	6	6	8	12	69	13	3
	26	27	7	4	21	4	4	6	21	115	36	3
	37	47	7	18	4	1	1	5	6	47	15	4
	16	17	5	8	4	4	4	1	6	15	6	-
	10	7	1	5	4	1	1	-	2	5	2	1
	8	5	-	5	1	3	-	-	3	35	4	5
	1	7	6	4	1	-	-	-	1	8	3	5
	4	4	1	1	1	-	-	-	1	8	3	5
	200	277	50	119	129	37	41	123	591	189	47	1990
Indoor												
Clerks												184
Salesmen etc	14	18	4	16	9	2	2	2	12	57	23	4
Miscell.	11	3	-	1	1	2	-	-	1	12	5	1
Students & Teachers	4	6	-	1	4	-	-	-	1	3	-	-
Printers & Compositors	2	1	-	2	-	-	-	-	-	2	-	1
Outdoor												
Farmers & Farm Hands	49	47	15	45	53	14	14	14	50	179	50	18
Genl. Labour	24	26	7	4	12	6	6	8	12	69	13	3
Miscell.	45	37	7	18	21	4	4	6	21	115	36	3
Engineers	11	16	5	8	4	1	1	5	6	47	15	4
Carpenters	7	10	1	5	4	1	1	1	6	15	6	-
Painters etc.	5	8	-	5	4	1	1	-	2	5	2	1
Miners	5	1	6	4	1	3	-	-	3	35	4	5
Seamen	-	4	1	1	1	-	-	-	1	8	3	5





6. Age Incidence :: All Cases - See Graphs. + p.33

Pos.	Age Incidence						
	To 20	25	30	35	40	45 & over	
T.B.	14	78	64	33	14	4	... 207
Clin.	40	258	153	101	64	27	... 643
C.P.D.I.	10	111	76	45	22	13	... 277
Fibrosis	3	10	13	7	7	10	.... 50
Pleurisy	5	57	22	16	14	5	... 119
Pleu. c effusion	20	68	25	9	4	3	... 129
Br.Pneu.	2	20	9	4	4	2	... 41
Pneumonia	5	50	29	14	12	13	... 123
Bronchitis	19	141	115	78	96	142	... 591
Empyema	4	13	13	1	5	1	... 37
Asthma	6	38	57	31	20	14	... 169
Emphysema	2	3	5	5	12	20	... 47
							<u>2433</u>

7. Incidence Of Respiratory Diseases per cent compared with N.Z.E.F. as a whole.

Pos.	Indoor	Outdoor
T.B.	29.5%	70.5%
Clin.	30 %	70 %
C.P.D.I.	26.5%	73.5%
Fibrosis	16 %	84 %
Pleurisy	23 %	77 %
Empyema	20 %	80 %
Pneumonia	17.5%	82.5%
Bronchitis	20 %	80 %
Asthma	23.5%	76.5%
Emphysema	17 %	83 %
<hr/>		
Average N.Z.E.F.	30	70

Age Incidence per cent is shown in attached graphic charts.



RESUME

1. The outstanding feature of the Respiratory Diseases affecting men of the N.Z.E.F, has been their low immunity to attack by the organisms of catarrh.
2. This was one of the main causes of invaliding. The frequency of catarrhal attacks with lesions similar to Tubercular disease of the lungs was pronounced.
3. The percentage of Positive Tubercle of the lung is found to be about that of the British Army pre-war, taking statistics for 1913.
4. It was necessary to evacuate invalided men to New Zealand. This meant a long sea voyage of over six weeks in a crowded Transport. Thus it became necessary to use great care in classification, and the cases diagnosed Clinical Tubercle of the Lung amounted to a large number.
5. The improvement under changed conditions was rapid, and to avoid the stigma of Tubercle, the class of Chronic Pulmonary Disease Indeterminate was instituted. Men with the lesser apical changes were included in this class.
6. Comparison of histories as provided in Board Papers (Table 3) shews the similarities and variations in the three types of case.
7. The matter of diagnosis is open to question, and will be viewed by critics according to the value placed on Clinical signs and symptoms apart from the finding of the Tubercle Bacillus.



8. Tubercular diseases in New Zealand are not common. The view that the Clinical and CPDI cases are due to lighting of old foci in the lungs is not substantiated, but deserves consideration.
9. Sputum examinations shewed the presence of respiratory catarrhal organisms without the presence of T.B.; and it is probable that even the typical apical lesions are set up by the former alone.
10. The fact that the men were evacuated if still unfit for service after a period of three months or more, probably prevented the development of T.B. in a greater ratio. By watching the future of the suspects, fresh grounds for opinion will arise. In the meantime the men should not be lost sight of.
11. The class CPDI was composed of two groups as in Clinical and Positive T.B.—those arising insidiously, and those in which the lungs gave persistent apical signs following an acute pulmonary attack (Table 3).
12. Influenza was not found to be so common a cause in these classes as might have been expected. Slighter attacks of gas poisoning may have had something to do with the impairment.
13. Of other Pulmonary Diseases a group may be made of Pneumonia, Broncho-Pneumonia, and Pleurisy, including the cases of acute onset in the form which have been returned under T.B. (Positive and Clinical) and CPDI — This type of case shews a total of 694.





14. The Maori soldiers were very subject to Tubercle of the lung: their return for a small force is large. They affect the Ratios per 1000 in the Tables to some degree, and they are differentiated in important points.
15. Figures re Age incidence shew that the acute diseases are more prominent in the years up to 25, for the acute conditions - The experience of combatant officers that men between 25 and 35 years of age are the best soldiers is upheld. In the later ages Asthma and Emphysema are more apparent
16. Indoor and Outdoor occupations are not well defined among the agricultural population of New Zealand, where the towns are small, and short working hours allow of open air exercise. The Outdoor population includes a number of men who are much exposed to the weather and develop Bronchitis and Emphysema in their later years, while the figure for Pneumonia is high at all ages.

N.Z.E.F. admitted to Hospital in U.K. monthly for Respiratory Diseases.

	Asthma	Bronchitis	Congestion of Lungs.	Haemoptysis	Broncho-pneumonia.	Abscess of Lung.	Fibrosis.	Emphysema.	Silicosis	Pleurisy	Empyema.	Pneumonia	Sore Throat	Tonsillitis
1916														
Jan	3	53	-	-	4	-	-	-	-	3	4	19	-	6
Feb	5	30	-	-	2	-	1	-	-	15	-	15	-	11
Mar	12	25	-	-	-	-	-	-	-	9	-	8	2	10
Apr	3	59	-	-	4	-	-	-	-	23	-	12	-	12
May	4	43	-	-	1	-	-	-	-	14	-	16	3	12
June	10	55	-	2	-	-	-	-	-	34	-	18	1	13
July	5	114	-	1	6	-	-	1	-	29	-	22	4	19
Totals	37	379	-	3	17	-	1	1	-	132	4	110	10	88
1917														
Jan	6	153	-	-	13	-	-	-	-	26	-	23	9	18
Feb	7	143	-	-	7	-	-	1	-	47	-	49	9	13
Mar	5	80	1	-	13	-	-	-	-	41	1	32	8	23
Apr	4	56	2	-	14	-	-	-	-	32	1	37	3	14
May	2	46	-	2	12	-	-	1	-	42	2	40	9	23
June	4	20	-	-	6	-	-	-	-	27	-	14	3	19
July	2	33	-	1	8	-	1	1	-	20	1	21	-	13
Aug	3	47	-	-	3	-	-	-	-	28	1	26	1	19
Sept	5	37	1	1	6	-	1	-	-	15	-	16	4	14
Oct	18	72	1	1	2	-	-	1	1	27	2	10	2	27
Nov	6	105	1	1	5	-	-	-	-	24	-	21	5	23
Dec	11	106	1	-	3	-	-	-	-	31	-	20	1	19
Totals	78	898	7	6	92	-	2	4	1	360	8	309	54	230
1918														
Jan	11	181	-	-	11	-	3	-	-	61	1	28	10	34
Feb	6	101	1	-	10	-	-	-	-	34	1	19	4	32
Mar	2	132	1	-	9	-	-	2	-	54	1	20	8	41
Apr	5	48	-	-	3	-	-	1	-	38	-	33	2	47
May	1	38	2	-	4	-	-	1	-	22	-	25	2	30
June	5	40	-	-	6	-	2	1	-	28	1	19	4	19
July	2	38	2	-	8	-	-	-	-	27	-	23	21	2
Aug	3	42	-	-	6	-	1	2	-	25	1	21	5	33
Sept	7	134	-	1	5	-	-	1	-	33	1	33	-	29
Oct	2	79	-	-	18	-	-	1	-	23	-	46	-	37
Nov	4	89	-	-	24	-	-	2	-	19	-	41	2	23
Dec	-	86	2	-	14	-	-	6	-	26	-	32	1	24
Totals	48	1008	8	1	118	-	6	17	-	390	6	345	59	351
TOTALS	163	2285	15	10	227	-	9	22	1	882	18	764	123	669

792

For Tubercle of Lung and C.P.D.I. see boards.  
 The above are the disabilities notified by Hospitals on admission.  
 Several have since been boarded as C.P.D.I., T.B. Lung, etc.



### 9. AGE INCIDENCE

three periods compared to  
average N.Z.E.F. as a whole.

*See Charts.*

	Under 25 %	25-35 %	Over 35 %
Whole N.Z.E.F.	43	45	12
T.B. Pos.	45	47	9
Clin.	46	35	20
C.P.D.I.	44	44	12
Pleurisy	53	33	15
Pleur. effusion	68	26	5
Br. Pneum. Pneumonia	47	34	19
Bronchitis	27	32	41
Asthma	26	53.5	20
Emphysema	12	22	66



THE CONSTITUTION OF THE M.C.V. USED IN THE N.Z.E.F.  
PROPHYLAXIS WAS AS FOLLOWS.

<u>Organism</u>	<u>1st Dose.</u>		<u>2nd Dose.</u>		
Pneumococcus	50	Millions	100	Millions.	
Streptococcus	10	"	50	"	
B. Influenzae	10	"	30	"	
Staph. aureus	200	"	500	"	Organisms
M. catarrhalis	25	"	75	"	per 0.5 c.cm.
B. pneumoniae	50	"	100	"	
B. septus	50		100	"	

The vaccine was "polyvalent" in respect to each of the contained organisms - that is to say, many strains of each of the cocci and bacilli, selected on account of their typical characters, were used in preparing the bacterial emulsions from which the vaccine was eventually compounded.

Virulent Strains were procured from British hospitals, and from an infected troopship.

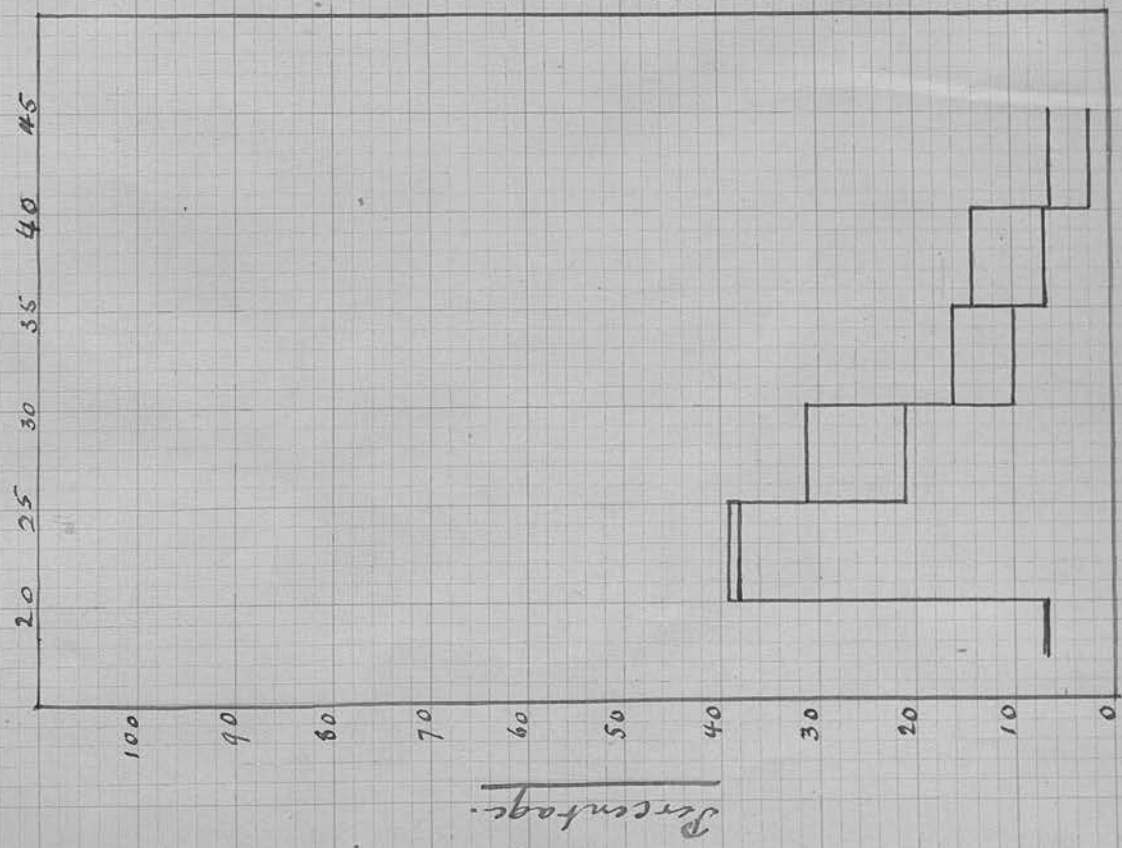
Eyre & Lowe.

Lancet. Apl. 5th, 1919.

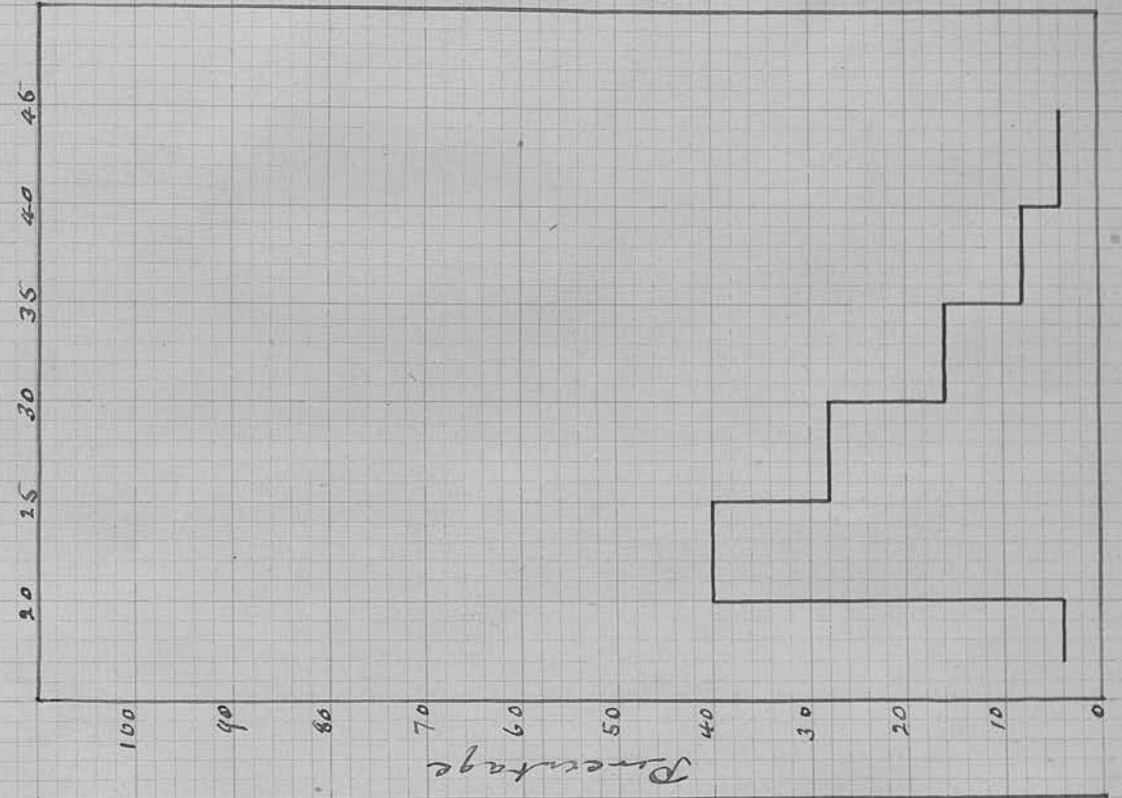


# Age Incidence of T.B. (Pos. + Clin.)

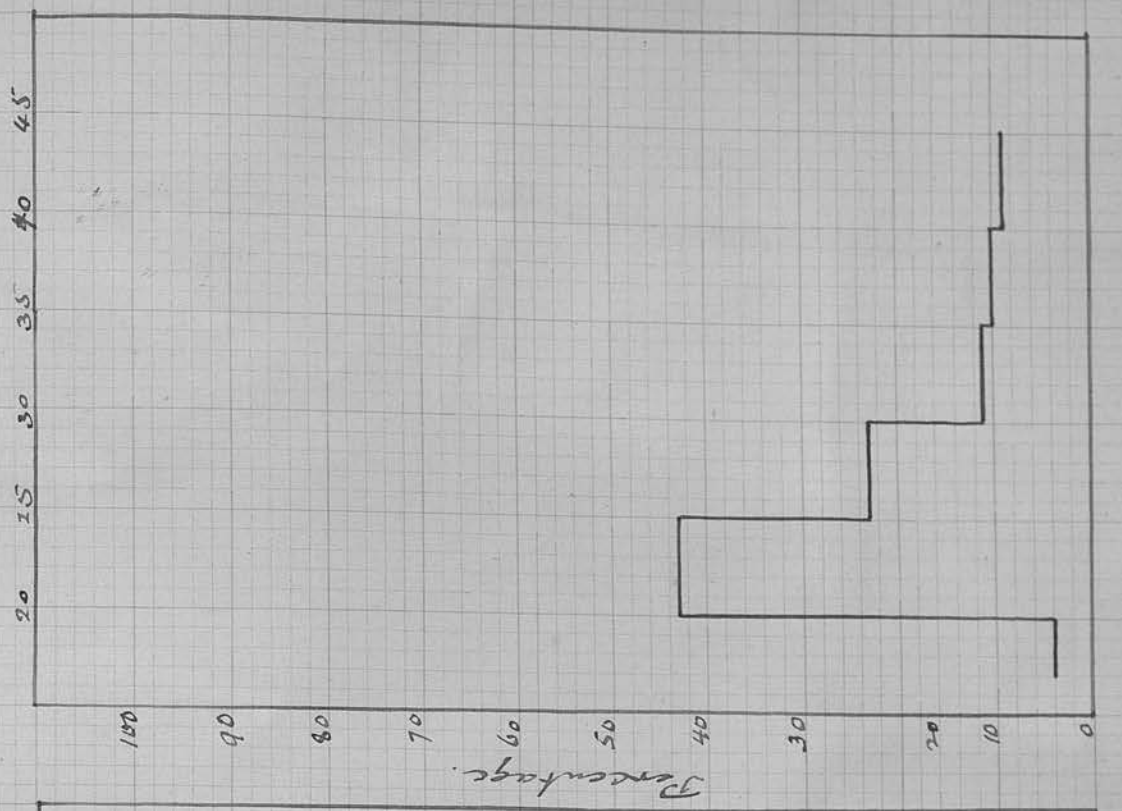
T.B. skin Black.  
Cl. - Red.



# C.P.D.I.

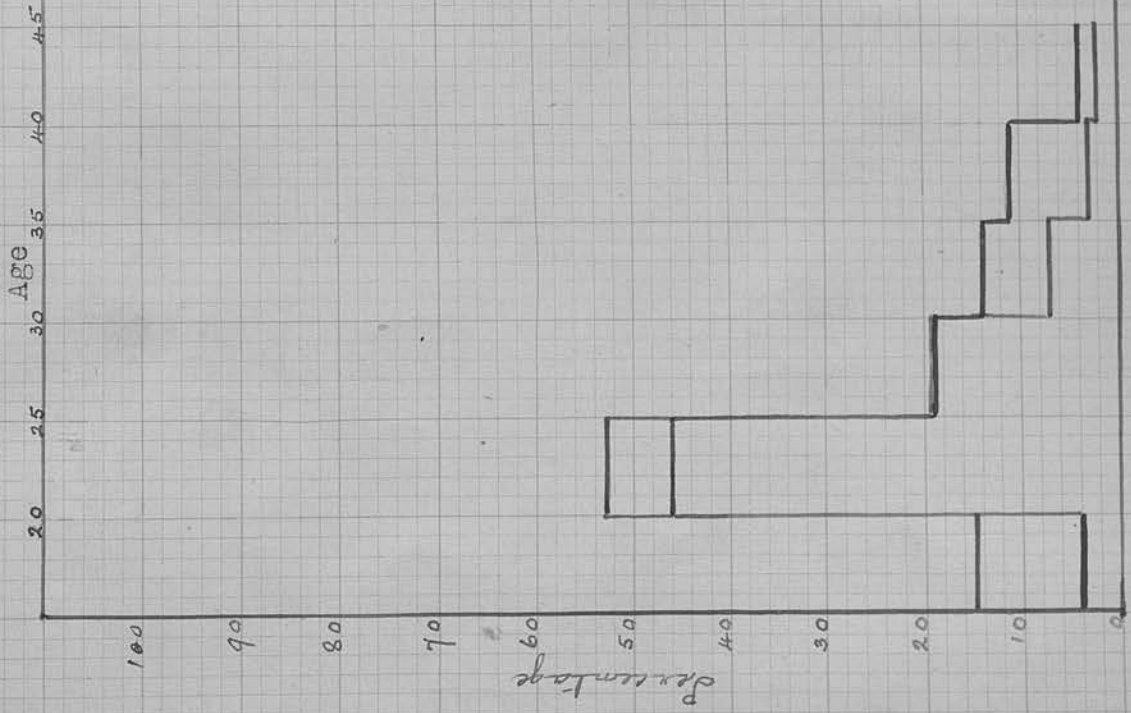


# B. Pneumonia + Rheum.



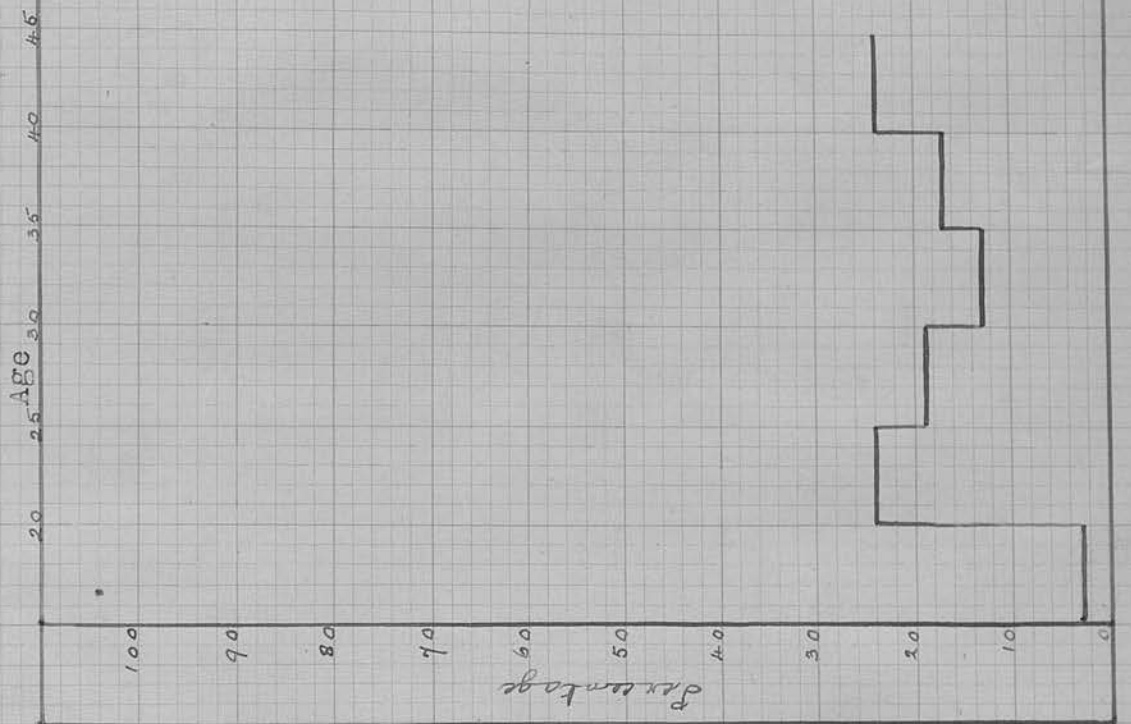
AGE INCIDENCE OF PLEURISY  
and PLEURISY c. effusion.

Pleurisy shown in black  
c. eff. shown in red.

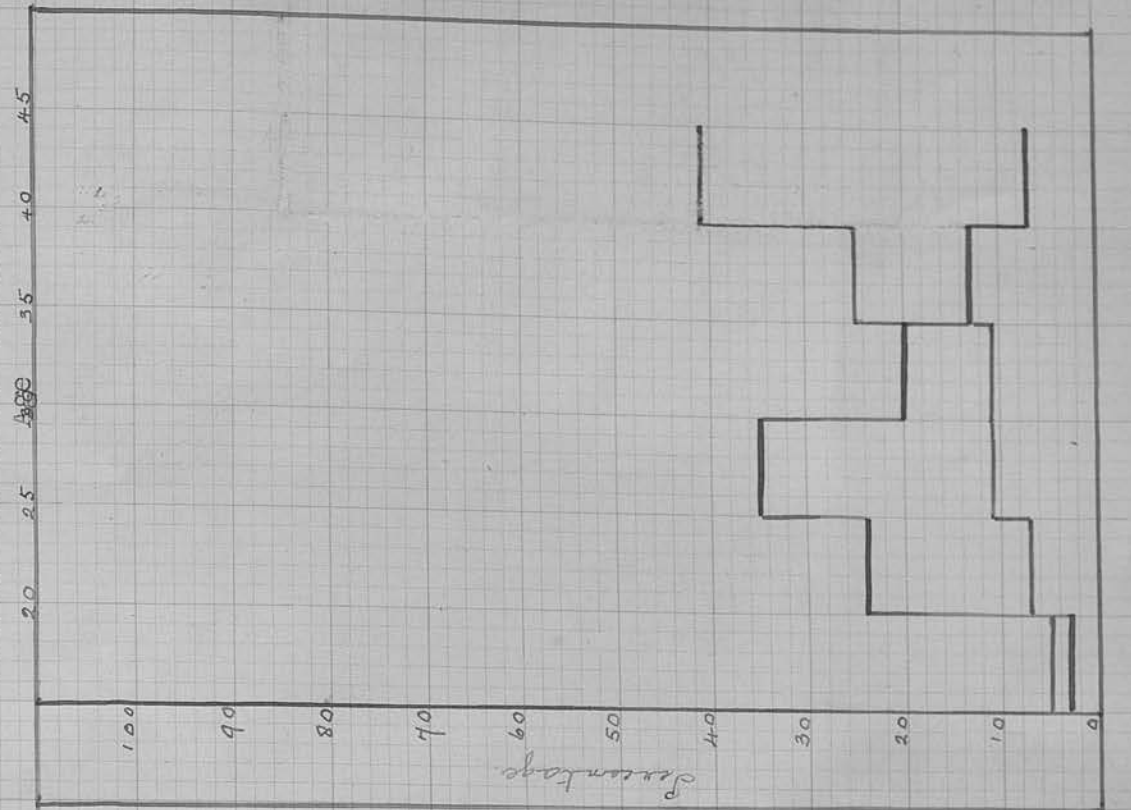


BRONCHITIS.

Asthma shown in Black.  
Emphysema shown in Red.



ASTHMA and EMPHYSEMA.



# Chart Showing Age Incidence -

3 Periods compared to average N.Z.F. as a whole.

