REPORT ON THE INFLUENZA EPIDEMIC AMONG THE TROOPS OF WOOLWICH GARRISON DURING THE WINTER 1926—1927.

By Captain R. R. Evans, Royal Army Medical Corps.

"No one has yet succeeded in achieving either a satisfactory definition of what is meant by influenza or a description, far less a regulation, of the usage of the word. . . . No real advance can be made in our science unless the relativity of our concepts is first admitted, and no useful concepts can be found unless the happenings are first observed patiently, separately and collectively."

It is a well-known fact that epidemics of influenza vary considerably in extent and severity; that some countries are affected differently; that different parts of any one country may be affected in varying degrees, and

---

1 F. G. Crookshank, "Influenza: Essays by several authors."
some communities more than others. Therefore, unless details are recorded of how any one community suffers, and to what extent the country suffers, no true picture can be formed of an epidemic as a whole and no advance can be made in our conception of influenza. In this report an endeavour has been made to record, as accurately as possible, the result of observation of the cases admitted into hospital from the Woolwich garrison of some 4,700 troops, and to note a few facts concerning the cases collectively and the epidemic generally.

The epidemic commenced with almost dramatic suddenness during the third week of December, 1926, and lasted up to the middle of April, 1927. During this time a total of 667 cases were admitted, and in addition nearly 100 cases were transferred from other districts. The first case was admitted into the Royal Herbert Hospital on December 16, and was quickly followed by many more cases, evincing the fact that the disease had broken out in epidemic form. The first few cases all belonged to the same battery of artillery and occupied two adjacent barrack rooms. These first cases were all characterized by suddenness of onset, severity of symptoms and marked prostration; they had all been attacked only a matter of a few hours before

---

Chart 1 (continued).
admission into hospital. Within a week of its commencement the disease had spread to other units, but the degree of severity of the symptoms, which was so noticeable a feature at first, was less marked later.

Chart 1 shows the daily number of admissions throughout the epidemic. When an allowance is made for the "spikiness" of the curves, which is due on the one hand to a dislike on the part of the soldier to reporting sick on Saturdays and Sundays, and on the other to an abhorrence of the Monday morning feeling—the astounding feature of this curve is the presence in it of waves. Chart 2 shows the number of admissions for the same period by the week—the human element here excluded, the waves are more marked still. Influenza, in common with other respiratory diseases, is increased in its prevalence during cold and frosty weather. Chart 1 shows the very intimate connexion that exists between minimum atmospheric temperature prevailing and the occurrence of cases of influenza.

![Image of Chart 1 showing daily admissions of influenza]

For ease of comparison the minimum temperature curve is shown immediately below the admission rate, but in the reverse way to which temperature is usually recorded, i.e., a fall being shown as a rise on the chart. It will be noted that a fall below freezing point in the temperature is followed on nearly all occasions by an increase in the number of cases admitted. The only notable exception to this occurs between Christmas and January 1, but as the great majority of the men were on leave during this period, it can hardly be called an exception, as possibly in other parts of the country the temperature was not as low as that recorded at the Greenwich Observatory, whence these figures were obtained.

Barometric pressure and humidity curves also bore a relation to the admission curve although not as close as that of temperature.

Chart 2, in addition to showing the weekly number of admissions, shows the lunar phases during the course of the epidemic. There is undoubtedly here also a very close relationship presumably brought about through the medium of the weather. Whether such close relation-
The Influenza Epidemic among the Troops at Woolwich

ship exists in other epidemics is doubtful and would be difficult to prove except where records are kept of cases as they occur. Unfortunately the returns of the Registrar-General are of no value in this respect as influenza is not a notifiable disease.

Chart 3 shows the daily hospital state of influenza, and the waves characteristic of the epidemic are very noticeable here also. This chart, although of little value at the termination of the epidemic, was very useful during its course when it was necessary to open up additional wards for the accommodation of increased numbers. In these figures are included about 100 cases admitted from districts outside Woolwich.

AGE INCIDENCE.

As already mentioned, the total number of admissions was 667. Table I shows these divided into age groups. Of the total garrison of 4,703 the ages were ascertained in 3,443 and the number falling into each group is shown. There is no reason for believing that the remaining number

whose ages were not ascertained would in any way alter the ratio of the various groups as it was composed of complete units. Therefore the number in each group has been estimated for the whole garrison, and of this number the percentage admissions are as shown:

It is noticeable that the incidence is highest in boys below the age of 18, and that it drops in each successive quinquennium up to 33. Over 33 there is a slight increase over the preceding quinquennium. This is
shown in diagrammatic form in Chart 4. Naturally too much reliance cannot be placed upon these figures, when estimating the actual incidence of the disease, as many of the younger men were admitted, although the disease was comparatively slight; and in the case of the older men, many of whom are non-commissioned officers and some married, facilities existed whereby the milder cases could be treated out of hospital, which did not exist in the case of recruits and young soldiers.

**TYPE OF DISEASE, SYMPTOMS AND COURSE.**

In practically all cases the disease was of the respiratory type. It has already been mentioned that the first cases of the epidemic were characterized by the degree of prostration, etc. These cases were possibly more nervous than respiratory. Apart from these, a few out of the total presented marked prostration—of a peculiar type somewhat resembling that of typhoid fever—with more marked pyrexia, usually prolonged to about ten days. Gastro-intestinal symptoms were present in only a very small proportion of the cases. A few also were afebrile, but otherwise presenting the same symptoms as the rest.

The symptoms complained of chiefly were headache, cough, soreness of the throat, aching of the limbs and back, pain over the front of the chest and general malaise. At the commencement of the epidemic the onset was abrupt, later more gradual. The appearance of the patient on admission was almost characteristic. He presented a languid and irritable look, some suffusion of the eyes with a frowning forehead, the face usually rather flushed, and a harsh, irritating and persistent cough, occurring in bouts, which accentuated the headache and the general discomfort from which he suffered. Early in the disease there was little or no expectoration. If left alone, he soon became drowsy and as a general rule slept well except when wakened up by coughing or aching limbs and back.

The appearance of the throat was also characteristic in the majority of cases. There was oedema and hyperaemia of the pharynx and uvula, and in most cases this was marked. The uvula was peculiarly lax and elongated and often lying against the posterior pharyngeal wall. The tonsils usually shared in the general oedema and hyperaemia, and occasionally the follicles were covered with a yellowish-white deposit of lymph. The lymphatic glands of the neck were swollen and tender on pressure. In some cases rhinitis, laryngitis and tracheitis were predominant features.

The chest signs varied and in rather more than half of the cases no signs whatever could be made out in the lungs. The signs presented at first were usually those of an acute bronchitis, which in the milder type of case cleared up quickly. Others in which the bronchitis was more intense ran a more prolonged course and still others developed broncho-pneumonia. Some of these cases had definite signs of pneumonia on admission. The degree of variations in chest signs was remarkable.

The fever lasted mostly from two to four days. In a fair proportion of
cases the temperature came down on the second or third day after admission. Others went on for a week or longer. Several cases in which the temperature had fallen on the third or fourth day of the disease developed a sudden rise of temperature again on the sixth or seventh day, but this second rise rarely continued for more than a day. The charts of these cases closely resembled those of dengue fever. If bronchitis was marked, the temperature would be prolonged.

Headache, at first a common and troublesome complaint, was found to be amenable to treatment, and was not often complained of after the first day. In a few cases, however, it persisted for several days after the fall of the temperature, with no other apparent sign.

The pulse-rate in all cases was peculiarly slow. So much so that it was found to be of considerable value in diagnosis. There was hardly a case on first admission that had a pulse-rate of over 100, even though temperatures ranged to between 100° F. and 104° F. A temperature below and up to 101° F. would be accompanied by little or no acceleration in the pulse-rate. A slow pulse persisted throughout the course of the disease in the absence of complications, and in most of the cases of bronchitis, broncho-pneumonia and other complications, the proportionately slow pulse-rate was still apparent. When the pulse-rate became rapid it signified either the formation of pus or a cardiac involvement. Apart from the slowness of the pulse there was nothing else particularly noticeable. Irregularities were seldom encountered.

Skin rashes were by no means uncommon and were usually of the general erythematous type affecting the trunk and limbs. The erythema varied in degree from a mild form to a generalized scarlatiniform eruption. This symptom often gave rise to great difficulty as several cases of scarlet fever occurred during the course of the epidemic, and some amongst patients in hospital with influenza.

The appearance of the tongue which has been described in influenza was not noticed in the epidemic. The sputum varied considerably; the greenish-yellow described by Pfeiffer being exceptional. Its quantity and appearance depended upon the degree of involvement and site of the main affection. It formed a useful guide as to the condition and progress during convalescence.

Complications and Sequelæ.

First and foremost among the complications was pneumonia, and this disease with its further complications was responsible for practically all the severe cases throughout the epidemic. Twenty cases were recorded, and both the lobar and lobular type were noticed, but the latter type was much the commoner. The rusty sputum and temperature falling by crisis, together with the usual clinical signs, were, however, present in two or three cases, so this type had to be looked upon as lobar. The pneumonia in some cases was ushered in early in the course of the influenza, others
had been under treatment either in or out of hospital for a number of days, and in one case of a rather severe, but short, attack, the temperature fell and remained normal for two days before pneumonia developed. The pneumonia, however, was an extremely severe form of the fulminating type, and the patient died within thirty-six hours. This was the only case of this type which was so common in the 1918 epidemic.

In the case of bronchopneumonia the onset was insidious or abrupt, with a sudden stabbing pain in the side, accompanied by a sudden rise in temperature. This type of case usually showed an area of pleural rub in the neighbourhood where the pain was complained of, and it was noticeable how often this particular area happened to be in the axilla—more often the right, over the area of the middle lobe. The right middle and two lower lobes were the areas chiefly affected by bronchopneumonia, and no case was encountered of upper lobes being affected without the lower lobes. The course of the pneumonia was variable, but usually prolonged, with temperature falling by lysis. In several cases the temperature remained elevated for nearly three weeks, and there was profound emaciation and debility.

Two fatal cases occurred during the epidemic, and pneumonia was responsible on both occasions.

Table II shows the cases of pneumonia divided into age groups similar to Table I. It also shows the liability to influenzal pneumonia in the various groups in the garrison (C), and to the development of pneumonia in cases of influenza (B). The remarkable feature of this table is the greatly increased liability to pneumonia in those over 33 years of age, and the still greater liability in cases of influenza over that age. This is shown more clearly in Chart 4.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Below 18 yrs.</th>
<th>18-23</th>
<th>23-28</th>
<th>28-33</th>
<th>over 33</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases of pneumonia</td>
<td>1</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Percentage of cases of influenza developing pneumonia</td>
<td>0·60</td>
<td>2·88</td>
<td>2·70</td>
<td>0·00</td>
<td>21·43</td>
<td>3·00</td>
</tr>
<tr>
<td>Percentage of number in Garrison developing pneumonia</td>
<td>0·14</td>
<td>0·54</td>
<td>0·21</td>
<td>0·00</td>
<td>1·19</td>
<td>0·43</td>
</tr>
</tbody>
</table>

Pleurisy, Pleural Effusion and Empyema.—Dry pleurisy was found both alone and accompanying bronchopneumonia. The commonest area affected was in the axillary line. It invariably commenced suddenly with a rise of temperature and a sharp stabbing pain. The usual signs were present, and the rub in some cases was distinctly palpable to the hand. These cases did well; the symptoms passing off almost as quickly as they arose and the temperature subsiding.

Two cases of pleural effusion were encountered. In both cases the diagnosis was confirmed by radiography. In one case the effusion was large and had to be withdrawn on several occasions in order to relieve the dyspnoea. In both cases the fluid withdrawn was sterile. Empyema
developed in only one case. The pus contained pneumococci and staphylococci, but no streptococci. Seven ounces of pus were withdrawn, but as no improvement followed he was operated upon four days later when a further ten ounces were evacuated. Good recovery followed. Both the cases of pleural effusion and empyema supervened upon attacks of bronchopneumonia.

**Bronchiectasis.**—One case was met following bronchopneumonia; large quantities of pus were coughed up for many days. Good recovery followed.

**Suppurative Tonsillitis.**—This was a common complication and in some cases was of a very severe character. Two cases developed a lymphatic exudation in the fauces and were suggestive of diphtheria, but this disease was excluded on bacteriological evidence. A few cases developed peritonsillar abscess.

**Laryngitis.**—This was frequently met, even in otherwise mild cases, and was usually resistant to treatment.

**Epistaxis.**—This was also fairly common and in most cases was accompanied by rhinitis.

**Tachycardia.**—This was a troublesome complication in one case. Recovery was slow, but eventually took place after prolonged rest in bed.

**Arthritis.**—Arthritis of the small bones of the wrist was met with in one case, but it was of a mild degree, and quickly cleared up without any special form of treatment.

**Acute Suppurative Otitis Media.**—This developed in two cases, neither of which gave a previous history of the disease.

**Boils and Abscesses.**—These were common, staphylococci being the infecting organism in these as well as in the previous affection.

**Herpes Labialis.**—This was fairly common, occurring chiefly in cases that had developed pneumonia.

**Asthma.**—This developed in one case which had been discharged from hospital three days previously on recovery from influenza. He gave no previous history. No special form of treatment was adopted and he recovered quickly.

**Bacteriology and Pathology.**

This part of the work was undertaken in the laboratory attached to the Royal Herbert Hospital.

At the commencement swabs were taken of the throats in all cases, and these were examined microscopically. Staphylococci and streptococci were present in all smears, pneumococci and Pfeiffer's bacillus in the majority and Micrococcus catarrhalis in some. As it was felt that no useful purpose was being served by this procedure it was later on discontinued; the swab only being taken to exclude diphtheria in cases that were in any way suspicious. A large amount of other work was, however, done. The urine was subjected to routine examinations in the majority of cases, and in seventeen
cases, mostly the more severe kind that had developed bronchopneumonia, the percentage of chlorides was estimated in the urine. The average worked out at sixty-six milligrammes per ten cubic centimetres.

White blood-counts were made in a number of cases without complications and in cases complicated by bronchopneumonia. The average worked out as follows:

<table>
<thead>
<tr>
<th></th>
<th>Uncomplicated cases</th>
<th>Complicated cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>8,280</td>
<td>13,252</td>
</tr>
<tr>
<td>Polymorphonuclears</td>
<td>54</td>
<td>75</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>Large mononuclears</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Basophils</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The sputum was examined in many cases with a result similar to those of the swabs taken from the throat. In seven cases the pneumococci present were typed with the following result:—Type I, nil; type II, 4; type III, 1; type IV, 2. In addition many other specimens of various kinds were examined at various times.

**Radiography.**

Considerable help was obtained from this method of examination in doubtful conditions of the chest, and whenever any doubt was entertained the patient would be examined by this means. It was found extraordinarily useful in watching the progress of the chest during convalescence.

**Treatment.**

_Prophylaxis._—Preventive inoculation was practised on a small scale at the commencement of the epidemic. A chart kept showing admissions by units showed a slight increase in the numbers admitted during the week following inoculation, but diminution during the rest of the month following. After a month had elapsed inoculation appeared to have little or no effect. The amount of vaccine required to inoculate the whole of the garrison would, of course, be considerable, and more than was available. For this reason, when the supply became limited, the plan was adopted of inoculating newly joined recruits only. This procedure made it difficult to keep any form of record of the inoculated cases for comparison with the uninoculated. It is believed, however, that complications were not as common in those who had been inoculated as in those of the same age who had not been inoculated.

In addition to inoculation other prophylactic measures were taken, such as the observance of proper ventilation of barrack rooms and institutes and the early isolation in hospital of the infected cases. Gargling and nasal douching were also practised as a daily routine amongst the troops. A solution of potassium permanganate 1/4000 was the one commonly used, and when carried out thoroughly and persevered with, it is a measure which is believed to reduce the incidence of infection.
Curative Treatment.—A routine treatment was adopted at the commencement and carried on throughout the epidemic. It was found to have a profoundly beneficial effect upon cases and consisted of the administration of the following: Calomel, 3 grains on admission; mist. expectorans sedativus and potassium permanganate gargles four times a day; pulv. ipecac. co., 10 grains on the evening of admission; magnesium sulphate (as required) the following morning; tinct. benzoin co. (one drachm to one pint) inhalation morning and evening. Pulv. ipecac. co. or aspirin would be ordered specially on the second or on successive days as found necessary. When the character of the cough and expectoration warranted it, the sedative expectorant mixture would be discontinued and replaced by mist. expectorans stimulans. The inhalations were continued until the expectoration ceased. When the temperature had been normal two or three days and the tongue had cleaned up Easton’s syrup was given three times a day. The value of the treatment could easily be gauged by comparing the relatively calm and comfortable patient with his condition on admission twenty-four hours previously. Various writers have stressed the value of opium in influenza and state that its effect may almost be considered to be specific. The experience gained in this epidemic has gone all in favour of this claim, and there is little justification for withholding it once the diagnosis is made and there are no contra-indications. The inhalations were also found to be very beneficial.

The composition of the mixtures used is as follows:

<table>
<thead>
<tr>
<th>Mist. expect. sedativus.</th>
<th>Mist. expect. stimulans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Tinc. camph. co.</td>
<td>R Ammon. carb.</td>
</tr>
<tr>
<td>Vin ipecac.</td>
<td>Liq. ammon. acet.</td>
</tr>
<tr>
<td>Oxymel scillae</td>
<td>Vin ipecac.</td>
</tr>
<tr>
<td>Aquam ad</td>
<td>Aquam ad.</td>
</tr>
</tbody>
</table>

In conclusion, I desire to express my gratitude to Colonel J. A. Hartigan, C.M.G., D.S.O., K.H.P., R.A.M.C., for the facilities afforded me during the epidemic and for many excellent suggestions and advice at various times; to Major S. Smith, R.A.M.C., for his guidance and assistance in supplying details after my departure from Woolwich; to the Staff of the Laboratory and the Radiological Department and to members of the Q.A.I.M.N.S. and N.C.O.’s, and Other Ranks of the Royal Army Medical Corps who served in my wards at various times and without whose assistance this record would not have been possible.