be very depressing. The average value of the seven Lancastrian industrial towns is 26.9 years. Between the rural areas of different parts of the country the administrative counties of Westmorland, Dorset, Wiltshire, the rural parts of Norfolk, Suffolk, Devon, and Derby there is hardly any difference—the lowest is 27.7, the highest 27.9, the average 27.8. Therefore every man who passes his productive years from 25 to 55 under the rural conditions will have 0.9 of a year more to live in that productive period than a man of the same entering age in the industrial towns; the urban man power is 96.76 per cent. of the rural man power, defining man power as years of life lived from 25 to 55. Put in other words, were the urban conditions hygienically as good as the rural conditions the urban population might be reduced to 96.76 per cent. of its strength, and it would possess precisely the same productive power as now, although these rural samples themselves only yield 92.67 per cent. of the theoretically possible span, thirty years.

As a further illustration, I consider the partial expectation at 20 for the thirty-five years to 55 (males). Having applied the method to the ten industrial registration districts of Stoke-on-Trent, Wolverhampton, Walsall, West Bromwich, Dudley, King's Norton, Birmingham, Aston, Leicester, and Nottingham, and to the agricultural district formed by excluding the registration district of Lincoln from the registration county, the following results were reached:

In 1851-60 the urban man power was 95.7 per cent. of the agricultural man power; in 1901-10 it was 97.1 per cent. of it. Sixty years ago the Lincolnshire males lost 13 per cent. of their possible time, and now lose 8.4 per cent. Sixty years ago the urban males lost 16 per cent., and still lose 11 per cent. (Greenwood, p. 178). Again, I make the reservation that results based upon the mortality of two years (which is the case of the figures used above and referring to 1911-12) have only the value of samples, and are subject to errors of sampling. Space does not permit me to discuss the evaluation of the error of sampling for a somewhat complex expression such as the partial expectation, but I find it to be of the same order as that of the death rates, and there is little reason to doubt that the kind of difference shown in these few examples is of the order of magnitude of the "true" difference.

THE VALUE OF VACCINES IN THE TREATMENT OF WHOOPING-COUGH.

BY

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THE object of this paper is to record some observations on and the results of vaccine treatment of cases of whooping-cough. The majority were out-patients, a few being in-patients, at the Hospital for Sick Children, Great Ormond Street, during the months of January, February, and March, 1922.

For purposes of age and sex incidence we have included all those cases of whooping-cough which attended the out-patient department of this hospital during the year 1921 and the first 196 cases that attended in 1922, making 1,000 cases in all. The seasonal incidence has been taken from the 804 cases attending during 1921.

CHART 1.—Seasonal incidence, 1921. (Based on 804 cases.)

As will be seen from Chart 1 the seasonal incidence reached its maximum in June, when there were 109 cases, and fell to the minimum in November, when there were 25 cases. The sex incidence shows 530 girls to 470 boys. The age incidence (see Chart 2) shows the maximum at 1 to 2 years, and the vast majority occur before the age of 6 years, or within twelve months of starting school.

Symptoms.

The average duration of the cough before the onset of the whoop in 100 of our cases seen during January, February, and March, 1922, was two weeks. In some cases the whoop started

within a few days of the onset of the cough, but in other cases was delayed as long as three to four weeks.

The onset, duration, and termination of the whoops and vomits were on the average identical. At the onset the

CHART 2.—Age incidence. (Based on 1,000 cases.)

whoops were much more severe and frequent during the night than by day. As the disease declined the whoops became gradually less during the night, and in the later stages of the disease were entirely confined to the day.

In very young children gross wasting as a result of the incessant vomiting was a very serious feature, and was of importance even in the older children. Where vomiting was severe obstinate constipation was a concurrent symptom.

A sublingual ulcer was looked for on at least one occasion in 62 cases; it was present in 11, or 18 per cent. In several it was not present at the first examination early in the disease; it was usually found to develop during the second or third week. In 9 of these cases, or 82 per cent., the age of the children was between 1 and 3 years. The ulcer healed very rapidly; a careful and continuous search would, we have no doubt, reveal this ulcer in a much larger proportion of cases.

Bronchitis is present in the majority of cases. The signs may be scattered rhonchi; and early in the disease, almost at the level of the diaphragm, a girdle of fine crepitations is very frequently heard. In small children massive collapse, dyspnoea, and cyanosis sometimes complicated the clinical picture and gave rise to the diagnosis of bronchopneumonia. These physical signs are, in our opinion, brought about by the thick tenacious secretion present in the bronchi plugging the smaller bronchioles of the most dependent parts of the lungs, thus giving rise to collapse in this area with consequent fine crepitations.

In 4 out of 80 cases the tonsils had been removed. In 18 cases there was injection but no enlargement; 18 others showed moderate enlargement with injection; in the remaining 40 cases, or 50 per cent., the tonsils were grossly enlarged and injected. The injection is, no doubt, secondary to the coughing.

Duration.

The average duration of the disease in our 100 cases, as measured from the onset of the cough to the termination of the whoop or vomit, was six and a half to seven weeks, while the average duration of the whoop was four and a half to five weeks.

Complications.

Epistaxis was a not infrequent complication, and was much commoner in older children, though of minor importance. Bronchopneumonia, on the other hand, occurred in 5 per cent. of 200 cases, but gave rise to grave anxiety, 4 out of our 10 cases proving fatal. Among other complications were subconjunctival haemorrhages and laryngitis; puffiness of the face was not infrequent, and in the more severe cases called for an examination of the urine to exclude nephritis. Pain, referred to the diaphragm, the intercostals, and the abdominal muscles, due to the violent straining and coughing, was frequently complained of by the older children. Convulsions occurred only in association with bronchopneumonia, and the two cases we observed both proved fatal. Post-mortem examination in one of them showed on microscopical examination marked cerebral congestion only.

In 5 to 10 per cent. of our cases a fresh attack of bronchitis caused a recurrence of the whoops.

Mortality.

The mortality in 200 cases observed during three months was 2 per cent.; these four cases died of bronchopneumonia, and two of them terminated in severe convulsions.

Diagnosis.

In the earliest stage, before the cough is paroxysmal or the whoop or vomit appears, the diagnosis is extremely difficult. A fretful, peevish child aged 1 to 3 years, with a short hacking cough, possibly laryngitis, slight unexplained pyrexia, and usually a girdle of fine crepitations at the level of the diaphragm, should make one suspect the onset of this disease. Briefly the clinical picture is that of an ill child; the physical signs are comparatively slight.

In the later stages the diagnosis becomes less difficult. The characteristic expiratory paroxysms with whoop and vomit, the slightly puffy face, the subconjunctival ecchymosis, the occasional epistaxis, and the presence of a sublingual ulcer, all point towards pertussis.

We have unfortunately occasionally observed this sublingual ulcer in children of the same age in which it commonly occurs in whooping-cough (1 to 3 years), and in these cases there could be no question of whooping-cough playing a part in its formation. We agree that these ulcers are formed by the tongue striking on the sharp lower incisors during the forcible expiratory spasms of coughing.

In our opinion the whoop is not necessary for diagnosis. In eight families where several children were suffering from undoubted whooping-cough one child was observed to have typical cough without the whoop. On the other hand, a typical paroxysmal cough with a vomit and a whoop may be found in cases of tuberculosis with caseous mediastinal glands. The presence of tuberculosis in other parts of the body and the length of the history may help to clear up the diagnosis. A foreign body in the trachea may also closely simulate pertussis in this respect.

Treatment.

The number of patients treated with vaccine and followed to their recovery was 64. Of these, 6 were given bi-weekly injections and treated as in-patients, while the remaining 58 were given weekly injections while attending the out-patient department.

Dosage of Vaccines.—The vaccine was supplied by a well-known London laboratory, and the dosage we employed was as follows:

Initial injection:			
Bordet's bacillus	...	...	500 million.
Influenza bacillus (Pfeiffer)	...	...	125 "
Pneumococci	...	...	25 "
Second injection:			
Bordet's bacillus	...	...	1,000 million.
Influenza bacillus	...	...	250 "
Pneumococci	...	...	50 "
Third and subsequent injections:			
Bordet's bacillus	...	...	2,000 million.
Influenza bacillus	...	...	500 "
Pneumococci	...	...	100 "

For the purposes of this paper the length of the disease was defined as from the onset of the cough to the termination of the whoop.

*RESULTS.**A. Vaccinated Cases.*

1. In 58 of the out-patient cases treated with weekly injections the average duration was 7 weeks; those treated within the first week of the onset showed an average duration of 5.7 weeks; those in the second week of the disease an average duration of 5.9 weeks; those in the third week an average duration of 7.2 weeks; in the fourth week an average duration of 7.6 weeks; in the fifth week an average duration of 9 weeks.

2. In the 6 cases treated with bi-weekly injections as in-patients the average duration was 6.6 weeks.

B. Non-vaccinated Cases.

The average duration of the disease in 42 control cases that were not treated with vaccine was 6.4 weeks.

Did the vaccine shorten the duration or severity of the whoop?

In the vaccine-treated cases the average duration of the whoop was 4.8 weeks; in the non-vaccinated cases 4.4 weeks. Even in the vaccinated cases treated in the first or second week, and occasionally before the whoop developed, the

shortening of the duration of the disease would appear to be negligible. In several cases exposed to infection and seen early in the stage of incubation, vaccine treatment appeared to have no appreciable value as a prophylactic measure. It appeared to us that the vaccine which we used when given weekly, or bi-weekly, entirely failed to influence the duration or the severity of the disease either favourably or unfavourably.

The administration of vaccines to children presents difficulties. The injections were painful and upset the children considerably, especially the larger doses, so that they lost confidence in us. Unless whooping-cough vaccine can be shown to be of more therapeutic value than it has been in our hands, we consider that the distress to the child, and the risk of losing his confidence, does not justify its use.

We lack experience in vaccine therapy and fully realize that the wrong organism, intervals between injections, and dosage may have been used in this investigation. We are of the opinion that the following points in treatment aid in the shortening of the disease and the prevention of complications.

Hygienic.—Fresh air seemed an all-important point, and undoubtedly those children allowed to run about outside with the usual precautions against exposure did much better than those confined to the house. Even those with a moderate degree of bronchitis benefited greatly with this treatment. Where there is insomnia and exhaustion, consequent on the greater severity and frequency of the whoops at night, this can be alleviated by getting the child to rest and sleep during the day.

Dietetic.—Anorexia and vomiting being constant symptoms, wasting was a constant sequel; it was often found necessary to vary the diet frequently, children taking and retaining cow's milk or some of the proprietary foods best during the acute stage. The all-important point seemed to be to prevent this wasting and to keep the child in as good physical condition as possible. The feeds were given in small amounts and at frequent intervals, and when possible immediately following on a paroxysm of coughing and vomiting.

Medicinal.—We found cod-liver oil and malt a most useful remedy. Children on this treatment actually seemed to put on weight, and during the stage of recovery from the disease a preparation of iron was added to the cod-liver oil with great benefit. To cases of bronchitis with numerous moist sounds in the chest the following mixture could be given with great benefit to a child aged 1 year, and in suitable doses to older children, every four hours:

Tincture of belladonna	...	...	...	mij
Potassium bromide	...	...	...	gr. iij
Glycerin	...	...	...	mx
Water	...	...	...	to 3j

All our cases, both vaccinated and non-vaccinated, were given cod-liver oil and malt in suitable doses, with a liniment for the chest.

Our thanks are due to Miss Marian A. Lawson, of the Royal Free Hospital, for her very valuable assistance in administering the vaccines.

AN ARTERIO-VEIN ANEURYSM TREATED BY LIGATION OF THE LEFT SUBCLAVIAN ARTERY.

BY

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LIGATION of the first part of the left subclavian artery is so rarely done that I think the following case may be worthy of record.

History.

A man, aged 24, was admitted to the Norfolk and Norwich Hospital on June 6th, 1921, complaining of swelling of the left upper extremity. He stated that while serving in France he was wounded in the region of the left clavicle on May 17th, 1917. After receiving treatment in various hospitals he was discharged from the army in November, 1917, on account of pain and weakness of the left arm. At the time of his discharge from the army the arm was not swollen, but at the end of 1918 he began to notice gradual increase in size of the whole of the left upper extremity, and a pulsating swelling appeared in the region of the left clavicle. The size of the arm continued to increase until there was very little use in it, and he had to carry it about in a sling. Dilated veins appeared on the surface of the axilla, arm, and forearm, and the skin of the left upper extremity assumed a dull livid colour. A superficial ulcer appeared on the flexor surface of the forearm in June, 1921, and rapidly increased in size.