

that the chief outbreak of enteric fever in Blackburn followed close upon, and possibly was caused by, the occurrence of enteric fever at Belthorn and Shorrock's-row. The water on leaving the culvert, just within the wall of the reservoir enclosure, runs in an open enclosure for 20 or 30 yards before discharging into the reservoir. An empty can or two lying in this channel showed that it was exposed to casual additions and I noticed just within the gate of the enclosure and immediately over the mouth of the culvert the remains of human ordure. In the side of the open channel is a gate-slucice which, when desired, can be set open so as to divert the stream, or part of it, into an open by-channel which runs down between the Guide embankment and the public road and is finally turned into the lower (Fishmoor) reservoir. In its course it receives the contents of a ditch which, when traced back, is found to take origin at the back of some dwellings in the upper part of Guide village, whence it comes along a cartway trodden and befouled by cattle, past a farm-yard, and through a field, exposed in its whole length to the risk of pollution. I heard tales also of mischievous fellows throwing 'nast' (filth) into the reservoirs themselves. The six-foot enclosure wall is easily climbed."

Dr. Airy then shows how one of the privies had been shortly before the outbreak infected by the stools of a man, Aspden, who had typhoid fever and goes on to say: "This case was not visited by the medical officer of health nor by the inspector of nuisances; the danger to the public health attending the presence of a case of enteric fever so near the main artery of the water-supply was overlooked. An unskilled labourer who works under the nuisance inspector was sent to the house with some carbolic acid powder. Aspden states that this disinfectant was used to discharges which were then thrown into the privy, one of the row of privies that have their pits opening to the meadow through which the water-culvert passes. Slops and rinsings of vessels undisinfected were thrown down a sink in the backyard or thrown into the road-side gutter in front of the house. Either channel would carry them, as already described, immediately over the water-culvert, at points where it was evident on internal examination that fluid was in the habit of oozing into the culvert. Any such admixture, supposing it to occur, would be infinitesimal in comparison with the quantity of water flowing in the culvert, and that again, in comparison with the whole body of water in the reservoir which received it, would be but as a river flowing into the sea. It certainly taxes the imagination to suppose that so minute a portion of infected matter would suffice to give a poisonous taint to so large a body of water, unless it possessed the property of self-multiplication." (Eleventh report of the medical officer of the Local Government Board, 1881.)

At Rotherham (Yorkshire) and two adjoining districts typhoid fever and "fever of a less definite sort" was again prevalent in 1891-92, and Dr. Theodore Thomson reported that it was "not due to sewerage or drainage, nor to excrement disposal, nor to milk-supply, but to a public water-supply common to the invaded parts of each district" and to the high-level section of it, which section was shown to have been similarly related to fever prevalence in previous years. In a subsequent report Dr. Thomson shows that this water was contaminated by being collected from gathering grounds which "contained a great deal of cultivated ground which is manured not only with farmyard but also with privy midden refuse, and sewage from villages as well as from detached houses finds its way into the water-supply, more especially on the high-level gathering grounds."

In 1896 Dr. Bruce Low reported on an outbreak of fever at Penrhynside (Carnarvon). The nature of this disease was "at first obscure; some cases resembled typhus, others cerebro-spinal fever, and a few influenza; ultimately malady regarded as true enteric fever; infection imported. The water-supply was from an extension of the Llandudno water-mains. At the time of the outbreak the pipes were encrusted and partially blocked. There was no evidence of pollution of this public water-supply. The service was scanty and intermittent, "causing the villagers to seek temporary supplies from springs and spouts on slopes of hillside below village. Some of these temporary supplies were most probably polluted by washing of surface filth from village down the slopes by heavy rainfall; hence the spread of the disease."

In 1897 Dr. Bruce Low reported on an outbreak of typhoid fever in the Horsforth Urban District (Yorks.). He found that the gathering ground for the water company was

high-lying pasture land dressed freely with stable manure and night-soil and that the sewage from farmhouses and also road washings reached the feeders of supply. "Sand filtration was provided, but in summer months as well as at other times it has been customary to turn on unfiltered compensation water to the town mains to augment supply. Following use in September, 1896, of this unfiltered water there occurred a sudden outbreak of enteric fever in October, attributed by the medical officer of health to polluted water of company's service."

In 1898 he also reported on a sudden outbreak of typhoid fever in December, 1899, in the town of Camborne (Cornwall) and an adjoining parish and village. The only condition common to these three places was their water-supply. "One of the two sources of this supply was from some springs at Boswyn, to augment which section of the supply a pipe had been laid from the brook to the service tank. The brook was fed freely by surface water from a hillside on which, in a cottage, four cases of enteric fever occurred in October and November, 1897. The bowel discharges of these cases reached a pond close to the house which had no privy. In wet weather the pond overflowed and the water from it ran down a channel to the brook, entering at about 100 yards above the intake pipe of the Camborne Company. In mid-November the rainfall was excessive and the flood-water washed out the pond and carried the pollution to the brook and thence to the service reservoir. After the removal of the pipe connecting the brook with the reservoir, and after cleansing the service tank and flushing the mains, the epidemic abruptly ceased."

In 1897 Mr. J. S. Davy, Dr. Theodore Thomson, and Mr. G. W. Willcocks were appointed by the Local Government Board to inquire into an epidemic of typhoid fever at Maidstone. This had been already investigated by Mr. M. A. Adams, the medical officer of health, who had come to the conclusion that it was caused by the pollution of some of the springs supplying the water company's water by the excremental matters from a colony of hop-pickers. The arguments used against this view were that there were cases of typhoid fever in Maidstone before the hop-pickers came at all, that many of the public sewers and house-drains and other sanitary appliances were in an extremely defective condition, so that contaminated air from them gained access to the houses, and that after the suspected water was cut off and a further period of 16 days allowed for incubation of any subsequent cases 357 more cases occurred in the town, which could not have been caused by the water—a contention which the inspectors say in their judgment is "in the main a just one," and that therefore the causes which operated to produce them might produce the whole epidemic, a condition which the inspectors admitted "is probably in some degree admissible." Nevertheless, the inspectors came to the conclusion that the epidemic was caused "by the pollution of the water supplied by the Maidstone Company from their Farleigh sources."

(To be continued.)

RESULTS OF THE VACCINATION OF 1060 ADULTS.¹

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VACCINATION statistics are amongst the commonest and best known statistics on medical subjects, yet most vaccination statistics are founded on cases which are seen but twice by the vaccinator. It is somewhat rare for a practitioner to have an opportunity of observing the whole clinical course of vaccination in every individual whom he vaccinates; therefore the results obtained recently at the Metropolitan Asylum, Leavesden, may be of interest, especially at the present time.

It may first be pointed out that only adults (of ages varying from 16 to 95 years) are dealt with, and that most of the cases are revaccinations. This paper dwells more particularly on the clinical aspect of vaccination itself, and little reference will be made to the relationship between small-pox and vaccination. The figures given apply only to the female staff and female patients, a total of 1060 individuals. No very unusual phenomena were observed, but the cases were

¹ A paper read before the Windsor and District Medical Society.

sufficiently numerous, perhaps, to enable some conclusions to be drawn as to the frequency of occurrence of some of the common complications and sequelæ.

Of the material constituting the greater part of these cases it may be said that an asylum population should not be compared with a general one. It is true that, speaking broadly, the patients show to a marked degree a distinct deficiency in their sensory systems, and thus may give little or no evidence of slight disorders; but this is outweighed by the fact that they are remarkably prone to epidemic diseases, and that such diseases amongst them are usually of severe type. On the whole, therefore, it is probable that the results given below will not differ much from those obtained in ordinary practice.

The first important fact noted was the want of uniformity in the potency of different strains of lymph. Much has lately been written upon this subject, and our experience at Leavesden fully confirms the complaints which have been recently appearing in the medical press. Lymph was used from three different sources; lymph from source A proved to be almost inert, lymph B was not much better, but lymph C gave such excellent results that it was at once made the standard supply.

The figures for the female staff are given first separately, chiefly because they serve to illustrate very well the variable potency of lymph A and lymph C. Table I. was compiled after all doubtful cases and failures had been vaccinated at least three times.

TABLE I.—*Showing the Results of Vaccination among the Female Staff.*

	Cases.	Successful.	Unsuccessful.	Percentage of successes.
Primary vaccinations... ..	2	2	0	100
Once vaccinated	82	81	1	98·7
Twice vaccinated	17	14	3	82·3
More than twice vaccinated.	4	4	0	100
Totals... ..	105	101	4	96·2

The inertness of lymph A was well shown by vaccinating 49 nurses with it; there were only eight successes, 16 being doubtful and 25 complete failures. The 16 cases which were "doubtful" were revaccinated with lymph C, and in every case good vesicles were obtained. The 25 cases of failure were also revaccinated with lymph C when 21 successes were obtained, only four being failures. The potency of lymph C was confirmed by the next 41 vaccinations of the staff with it, all of which were successful.

At the outset a very important question had to be decided—namely, on what grounds should it be deemed advisable not to vaccinate a patient. Small-pox existed in the metropolis and the object of the general vaccination was to prevent the disease making its appearance in the asylum. The important safeguard of stopping the regular visiting to the patients had already been taken, but there still remained the every-day traffic between the asylum and the metropolis and the visits of the friends of those patients who were seriously ill. The weakest patients, therefore, were just those patients who came most in contact with London and were consequently most exposed to possible infection. On these grounds it was decided to vaccinate every patient with one exception—that of a patient who had obviously only a few days to live. It is pleasing to report that the vaccination of these weakly patients produced no untoward effects.

TABLE II.—*Showing the Results of Vaccination among the Female Patients.*

Total cases.	Successful.				Fair or doubtful.		Failures.
	Four vesicles.	Three vesicles.	Two vesicles.	One vesicle.	Four vesicles.	One, two, or three vesicles.	
955	890	3	2	1	42	9	8
	896				51		

Adding the totals of staff and patients together the results are that out of 1060 vaccinations, 997, or 94 per cent., were successful; 51, or 4·8 per cent., were doubtful; and 12, or 1·2 per cent., were failures.

An attempt was made to ascertain the numbers of those who had never previously been vaccinated, and also of those who had suffered from small-pox.

TABLE III.—*Giving the Cases in which there was no Evidence of Previous Vaccination.*

Cases.	Successful.	Failures.	Percentage of successes.
89	87	2	97·7

TABLE IV.—*Giving the Cases of Revaccination only.*

Cases.	Successful.	Doubtful.	Failures.
971	910 (93·7 per cent.)	51 (5·2 per cent.)	10 (1 per cent.)

TABLE V.—*Giving the Cases in which there was Evidence of Small-pox previously.*

Cases.	Successful.	Doubtful.	Failures.
45	40 (88·8 per cent.)	1 (2·2 per cent.)	4 (8·8 per cent.)

With regard to the great majority of the cases nothing more need be said than that they ran a perfectly typical course. Cases of acceleration and retardation of the pocks were observed but unfortunately records of them were not kept. Dealing first with what may be called preventable sequelæ, papules from irritation from the dressings, acne, boils, abscesses, and carbuncles were met with. Such sequelæ depend largely upon the personal cleanliness of the patient; it need hardly be pointed out that in many of the patients personal neglect is the rule, and that such patients, in spite of the vigilant attention of the nurses, will be prone to septic conditions of the skin.

Papules from irritation from the dressings.—These occurred in 24 cases, or 2·2 per cent., and in some the papules became pustular. They began as a rule close to the vaccinated area; another favourite site was over the deltoid, where the skin was rubbed by the bandage. All the cases quickly yielded to simple treatment.

Acne or pustules spreading beyond the vaccinated area.—This condition occurred in six cases. Two began on the tenth day after vaccination, one of which cases involved only the vaccinated arm; in the other case the arm and the leg on the vaccinated side were affected. One case began on the twelfth day when acne appeared on the arms and the trunk. One case began on the fourteenth day with pustules on the arms, the elbows, and the buttocks, and another on the seventeenth day with pustules on the arm and the trunk. All yielded to treatment in from seven to 14 days.

Boils.—These were late sequelæ and were noted in 21, or 2 per cent., of the cases. The earliest case appeared on the tenth day, one appeared on the sixteenth day, four on the twenty-second day, one on the twenty-fifth day, two on the twenty-seventh day, two on the twenty-eighth day, four on the twenty-ninth day, three on the thirtieth day, and three on the thirty-fifth day after vaccination. It is interesting to note that 13 of the cases occurred in the epileptic ward, and the epileptic patients include some of the dirtiest and most troublesome patients in the asylum. None of these patients were taking bromides. As a rule the boils were small and they were nearly all situated on the vaccinated arm and shoulder.

Carbuncles.—Carbuncles occurred in a phthisical patient of very dirty habits. She developed several boils on the back on the twenty-eighth day after vaccination. These she was continually scratching and rubbing, and in a week's time she had one large and two small carbuncles on the back, which required incisions.

Abscesses.—These occurred in four cases. One appeared 20 days after vaccination in the lower half of the posterior triangle of the neck. It was an ill-defined abscess and was

TABLE VI.—GIVING PARTICULARS OF 23 CASES IN WHICH ERYTHEMA FOLLOWED VACCINATION.

Simple Erythema (Four Cases).

No.	Years of age.	Date of the appearance of the rash.	Nature of the rash.	Distribution of the rash.	Duration of the rash.	Condition of the arm.	General symptoms.
1	—	Tenth day after vaccination.	A diffuse blush.	On the arms, the chest, and the legs.	48 hours.	Good vesicles; the arm slightly inflamed.	Temperature 99° F.; pains all over.
2	55	Thirteenth day after vaccination.	A bright-red blush.	On both elbows.	36 "	Good vesicles; the arm not inflamed.	None.
3	44	Third day after vaccination.	An erythematous blush.	On the arm and the wrist.	24 "	Arm not inflamed; the pocks matured normally.	"
4	40	Thirteenth day after vaccination.	A bright blush.	On the arms.	36 "	Good vesicles; the arm not inflamed.	"

Erythema of Punctate Type (Three Cases).

1	45	Eleventh day after vaccination.	Closely set vivid red spots of about the size of a pin-head.	On the forearms and the legs.	48 hours.	Good vesicles; the arm not inflamed.	None.
2	25	Thirteenth day after vaccination.	Finely punctate rash; the spots closely set and slightly raised.	On the abdomen and the groins.	36 "	Good vesicles; the arm rather inflamed.	"
3	60	"	Bright-red punctiform erythema.	On the buttocks, the back, and the elbows.	48 "	Good vesicles; the arm not inflamed.	"

Erythema of Papular or Urticarial Type (Six Cases).

1	26	Sixteenth day after vaccination.	A profuse crop of pale flattened papules.	On the chest and the back.	36 hours.	Good vesicles; the arm not inflamed.	None.
2	—	Eighth day after vaccination.	Small red discrete papules, some surrounded by an erythematous area.	On the arms, the hands, and the legs.	4 days.	Good vesicles; the arm rather inflamed.	Headache and malaise.
3	—	Twelfth day after vaccination.	Fugitive urticaria.	On the arms, the legs, and the trunk.	5 "	The arm took very slightly and was not inflamed.	Temperature 103° F.; malaise; itching.
4	—	Eighth day after vaccination.	Discrete red papules.	On the forearm and hand of the vaccinated arm.	48 hours.	Good vesicles (primary vaccination); the arm much inflamed.	Malaise and headache.
5	71	"	Flat, discrete, pale red papules.	On the elbows, the forearms, and the shoulders.	48 "	Good vesicles; the arm not inflamed.	None.
6	73	"	Flat discrete papules.	On the arms and the shoulders.	48 "	"	"

Erythema Multiforme (10 Cases).

1	60	Tenth day after vaccination.	Irregular blotches of bright red erythema, fading on pressure.	On the arms, the legs, and the buttocks.	48 hours.	Good vesicles; the arm not inflamed.	None.
2	44	Eighth day after vaccination.	Large irregular patches of brilliant erythema, diffuse, duller red and not fading on pressure on the legs.	On the arms, the shoulders, the trunk, and the legs.	4 days.	Good vesicles; the arm moderately inflamed.	Malaise for 24 hours.
3	71	Ninth day after vaccination.	Bright red blotches.	On the arms, the body, and the legs.	48 hours.	Good vesicles; moderately inflamed.	Slight malaise.
4	61	Eleventh day after vaccination.	Brilliant red irregular blotches; next day a dull punctiform rash.	On the arms and the legs.	"	Good vesicles; not inflamed.	None.
5	60	"	Diffuse vivid red erythema; in parts large irregular blotches.	On the trunk, the arms, and the legs.	"	"	"
6	69	"	Brilliant red papules on the legs; a diffuse red blush on the arms; next day a dull, red erythema on the limbs and fresh papules; on the next day areas of erythema circinata spreading over the trunk.	On the trunk, the face, the arms, and the legs.	6 days.	"	Loss of appetite; malaise; temperature 100° F.
7	80	Ninth day.	Blotches of bright-red erythema, with slightly raised and well-defined margins.	On the trunk.	48 hours.	"	None.
8	56	Tenth day after vaccination.	Irregular patches of bright-red erythema and a few papules.	On the elbows, the wrists, and the knees.	48 "	Good vesicles; moderately inflamed.	"
9	54	"	Vivid red blotches with well-defined and sinuous margins. Fading on pressure.	On the trunk, the legs, and the arms.	48 "	Good vesicles; the arm inflamed.	Slight malaise.
10	26	"	Irregular red patches.	On the arms and the trunk.	36 "	Good vesicles; the arm not inflamed.	"

accompanied by loss of appetite and malaise. In another case a subcutaneous abscess appeared between the pocks on the twenty-fourth day. In another case a few boils appeared on the arm on the twenty-ninth day; these were followed by cellulitis of the arm and suppuration. Lastly, a small superficial abscess occurred in the axilla of a patient on the thirty-second day. All the cases healed rapidly and well after incision.

Reappearance of old skin trouble.—This was noted in a woman who had been long subject to psoriasis. A small patch appeared on the trunk on the thirteenth day; it cleared up in a week.

Eczema.—There were three cases in which eczema appeared. One was that of a nurse in whom a crop of papules appeared on the wrists and forearms on the tenth day after vaccination; the papules rapidly became vesicular. There was no constitutional disturbance and the rash cleared up in a week. In the other two cases a papular eczematous rash appeared 28 and 36 days respectively after vaccination, but lasted a few days only.

Herpes.—In one case a patch of herpes rather larger than a shilling appeared on the cheek 18 days after vaccination. It rapidly cleared up.

Erythematata.—These occurred as simple erythematous blushes, as finely punctate erythematata, as erythema of papular or urticarial type, and as erythema multiforme. In all there were 23 cases, or 2.1 per cent. of the total vaccinations. The erythematous rashes occurred in these cases as a rather later phenomenon than is stated by Acland in Clifford Allbutt's "System of Medicine." He gives the time of occurrence of the erythematous rashes as from the third day up to the time of maturation of the pock. In these cases one appeared on the third day, five on the eighth day, two on the ninth day, five on the tenth day, four on the eleventh day, one on the twelfth day, four on the thirteenth day, and one on the sixteenth day after vaccination. All ages were liable, four cases occurring in patients over 70 years of age. As a rule there was a little constitutional disturbance, but in several of the cases the patients made no complaint. In only one case was there severe constitutional disturbance and that patient recovered rapidly when the rash faded. The average duration of the rash was about 48 hours, but in the severe case above mentioned it lasted six days. Rashes occurred in patients whose arms ran a perfectly aseptic course; they were therefore regarded as a true vaccinal complication—a conclusion, however, which can only be accepted with reserve, as septic absorption gives exactly similar rashes. The rash looked much more alarming than the actual condition of the patient warranted, for in several cases with most vivid rashes there was practically no disturbance of the general health of the patient.

Auto-inoculation.—In five cases there was auto-inoculation. In three there was a small vesicle about one inch distant from the nearest inoculation. In one case there was an outlying vesicle two and a half inches from the nearest inoculation and in another there were two vesicles half an inch away from the nearest original insertion. These vesicles matured at the same time as the original inoculations.

Generalised vaccinia.—Of this condition there was one case in a patient, aged 31 years. Four good vesicles were inspected on the eighth day. On the next day additional vesicles appeared on the arms, the face, and the chest. The vesicles were not compound, were oval in shape, about a quarter of an inch long, and contained pale turbid lymph. Each was surrounded by a slight inflammatory areola and there was some malaise. A few more vesicles appeared in successive crops during the next three days, then they cleared up quickly and well, leaving no scar.

The very slight disturbance of the general health of the patients by vaccination was very noticeable. It was found convenient to vaccinate all the patients in a pavilion on the same day. It therefore happened that there were under observation from 120 to 150 patients in each pavilion and all in the same stage as regards their vaccination. Speaking broadly, it may be stated that the appetites of those vaccinated remained good, the patients looked well, and those of them who were usually engaged in the domestic work of the asylum were able, with very few exceptions, to perform their duties without difficulty. Of the nurses three were sent off duty, one of them being a case of primary vaccination and another was a rheumatic subject whose indisposition was possibly as much rheumatic as vaccinal. The effect produced in the minds of all who observed the cases was that the consequences of vaccination had been unduly magnified by alarmists. Cases, of course, occurred in which there was

considerable constitutional disturbance, with headache, pains all over, lassitude, and pyrexia, but they formed a very small proportion of the whole number of cases.

With regard to what may be called the preventable septic complications of vaccination, most will agree that the figures are not unduly high, yet it must be remembered that many of the patients are dirty rather than cleanly in their habits, and are therefore predisposed by their habits to such complications. In ordinary practice these figures should come out very much lower.

It does not require any very vivid imagination to picture the state of an institution such as Leavesden Asylum if small-pox broke out amongst the patients, but no one would have guessed from an ordinary inspection of the asylum that the whole of the patients were down with vaccination. It is very satisfactory to be able to report that although the feeble and the aged patients were all vaccinated yet no unfavourable results followed.

Table V. is of interest in showing the high percentage of successful vaccinations among those persons who had previously had small-pox, a fact which tends to show that vaccination is a better protection against small-pox than small-pox is against vaccination.

With regard to the lymph used, it is important to note that a staphylococcus was grown from it. In spite of this the majority of the arms showed only the inflammatory reaction of vaccinia, so that it is probable that those arms which were much inflamed were infected subsequently to the vaccination. In a few cases, however, it was thought possible that the staphylococci in the lymph were responsible for an inflammatory blush which appeared on the third day at the seat of inoculation and which was accompanied by enlargement and tenderness of the axillary glands and oedema of the arm. The inflammatory symptoms in these few cases subsided before the pock matured and the vaccination afterwards ran a normal course in them. It is most unsatisfactory to know that there is useless lymph on the market—a source of very grave danger both to the public health and to the reputation of vaccination. It should be our duty as medical men to guard jealously the fair fame of vaccination from the slanders of the anti-vaccinationist, and to do this we must vaccinate efficiently. This is not the place to discuss the question of efficient vaccination, but it will suffice to assert that it is possible for revaccination to produce vesicles as typical as those of primary vaccination and in such cases the individual may be regarded as efficiently vaccinated. For this efficient vaccination a potent lymph is essential, and it should be our duty to produce a lymph which we can be sure will always give good vesicles except in those cases protected by previous vaccination, by small-pox, or by natural immunity. The bacteriologist has still to discover the specific active agent of vaccinia; when that has been discovered it may then be possible to use a standardised lymph free from extraneous micro-organisms. It is surely not improbable that in the future there will be vaccinia units injected in known doses and with as little fear of septic complications as there is at present in the injection of antitoxins. The complications of vaccination after all are chiefly due to neglect of surgical principles, and the vast majority of bad arms with their accompanying malaise are preventable.

At this particular season the slight constitutional disturbance caused by an aseptic vaccination cannot be too strongly emphasised, and even weakly people can therefore be told that with suitable care they may be safely vaccinated.

King's Langley.

BRISTOL ROYAL INFIRMARY.—The annual meeting of the governors of this institution was held on March 25th, under the presidency of Sir Charles Cave. The medical report stated that 3246 in-patients had been admitted during 1901, against 2986 in 1900; the out-patients numbered 38,617, compared with 38,671 in the previous year. 410 maternity cases had been attended at the patients' own homes and 417 patients had been sent to the Queen Victoria Jubilee Convalescent Home. The financial statement showed that the total ordinary income for the year amounted to £11,467 and the total ordinary expenditure to £15,252. The total unfavourable balance of the infirmary now amounts to £9332. The committee has made arrangements for the introduction of the Finsen light treatment for lupus. The chairman made a strong appeal for increased financial support.