



*A Recent Epidemic of Small-pox,
with some Remarks on Revaccination*

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Tarbet-Loch Lomond.
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The epidemic which furnished the cases embodied in this paper occurred within the Parish of Arrochar and its neighbourhood about the end of last & beginning of this year - The victims, with two exceptions, were navvies working on the West Highland Railway - There were 2 principal centres of the disease; one a hut at Ardhuin on Loch Lomondside; the other a hut on Loch Long about 3 miles below Arrochar. To Ardhuin the infection was brought by a tramp who came from Edinburgh & lodged in the hut for nearly a fortnight: to Loch Long by another tramp, making his way from Portencaple to Craigmichael, who stayed for a few hours in the hut. In each instance I afterwards found the

men had left their trail elsewhere -
The first case which occurred was at
Ardlin 7 as there was no possible
hospital accommodation I at once turned
the hut in which the case occurred
into a hospital removing the men who
had been in contact to a second hut
which I afterwards kept as an observa-
tion & isolation house - As the other
cases cropped up they were removed in an
ambulance set aside for the purpose to
the hospital hut. The two case not
narrower were (a) a young boy who had
stood for a few minutes by a bed on
which a small port patient had lain
(b) a girl aged 11, but the source of
the infection was here so peculiar that
it will afterwards be alluded to.

The first Group comprises:

1. North Senr.

2. Hannigan

3. Graham

4. Casey

with one secondary

5. North Junr.

Case 1.

Thomas North - aged 48 years - navy
called to see him on 29th. Dec. I found
him in a condition of high fever - Breathing
short & shallow - somewhat delirious &
very restless. He had been seized the
previous evening with well-marked rigors
& vomiting & all night had suffered from
severe diarrhoea & constant dry distressing
cough. The temp. was now 104.5° - the
pulse rapid - face flushed, & he complained
of severe pain in the head & Breast, back &
Limbs. Examination of the Chest revealed
crepitant rales about the base of the
right Lung. Regarding the case as one
of Pneumonia I treated it accordingly.
Next day the symptoms above described
were of anything intensified - the temp.
higher - restlessness greater - & the cough

constant - Diarrhoea had however ceased.

The skin, especially of the trunk, was now covered with a diffuse scarlatina-like rash, but without any appearance about it

specially indicative of any of the specific fevers - This condition of affairs

lasted until the 2nd. of January - 5 days

after the onset - when there appeared a well marked papular eruption about the

face & wrists. At first the papules were not very numerous, but they quickly

grew thicker & spread to the arms & legs, but more sparingly to the body; where

most numerous appearing close set on

a thickened & reddened base - It now became evident that whatever the pulmonary condition, the patient was suffering from small pox.

From this point the case rapidly advanced without any apparent lessening of the

severity of the general symptoms - The rash went through its characteristic stages but the umbilicated vesicles formed, became pustular & broke much more quickly than one would expect. For the most part the pustules dried up & scabbed preserving the discrete form; but, especially on the face & on some portions of the arms they freely coalesced - the head itself was covered so that the hair stood up like a broom. The patient now suffered from great restlessness & uneasiness - he would take no nourishment but what was almost forced & there was profuse & constant salivation. Cough was also very troublesome & there was marked dullness at the base of the right lung. Pain in the head persisted - delirium was almost constant, of a restless troublesome kind, giving place

gradually to an apathetic & comatose condition until the 14th. January - the 17th day from the onset - when the patient died -

Regarding this case I would remark, that the pneumonic symptoms observable at the outset seemed to me to be well-marked. They persisted throughout & appeared to run along with the others more typical of small-pox - indeed to be almost separable from them. The appearances at the outset, the course of the temp., the character of the delirium, the cough & the physical conditions, all seemed to point to the view that there ~~was~~ ^{were} two sets of symptoms, the one an accident so far as the other was concerned. Whether this was so or the one set was only part of the other I am unable to say.

Another point of interest in this case is that the man had never been vaccinated until the day before the attack - I watched the vaccination mark carefully but though it became red & a good deal inflamed as the disease progressed it never formed a true vesicle - It seemed to me that the very recent vaccination had little or no influence on the progress of the disease; in other cases which I shall afterwards describe I was very firmly convinced ~~of~~ that vaccination or revaccination more remote by some days did greatly modify the disease & even abort it.

Case II.

Patrick Hannigan - 21 - Navy.

When visiting Case I. (North) my attention was directed to this man - He complained of shivering, feverishness, pain in the back & head, malaise &c. Nothing could be discovered about him to account for the condition; there was no cough & the organs were apparently all healthy -

This state of things lasted for some days during which I watched him carefully. But I could discover no sign of any eruption. The further symptoms of small-pox - He was quite well in less than a week. Yet I am very strongly of opinion that this man had the disease in an aborted form. I kept him several weeks in the hospital as a helper & during all that time he was constantly moving about among the patients &

sleeping in a neighbouring bed to theirs
in the same compartment of the hut.

He had got the infection from the same
source as Case 1. but he had been, first
vaccinated in infancy & successfully
revaccinated a few days before the onset.

The two following cases were also re-
vaccinated at the same time as Hannigan
i.e. Dec. 27., both successfully; but
they do not require much comment.

Case III

James Graham - 24. Navore
did not complain of anything particular
until the 3rd. Jan'y. when he noticed a
few papules about his face & wrists -
He then said that for a few days he
had been feeling out of sorts - a little

feverish, some headache, & pains in the arms & legs: there was no loss of appetite & the general condition was good. In a few days the papules became larger & redder but gradually died away without even becoming vesicular -

Case IV.

James Casey - 50 - navy
very similar to the preceding, & would probably have passed unnoticed but for his companionship with Graham - On the 3rd. June, also he discovered one or two papules on the face & afterwards one or 2 on the breast - these also enlarged & grew darker in colour, but entirely faded away without passing through any further stage -

This patient had slept for more than a week with the man who had originally brought the disease to the hut, & who was not detected until pustulation was well advanced.

Thomas North Junr. 19 - Navy

This case occurring secondarily from the preceding ones was of a somewhat different type. When the first case occurred I had, as formerly stated, revaccinated all the other inmates - 19 in number - & removed them to an isolation hut. This man alone refused revaccination & he alone afterwards developed the disease - He further in the first few days of isolation repeatedly visited his sick ^{father} in the hospital, thus repeatedly disobeying the injunction I had previously laid on him. It is right however to state that he had one good vaccination mark infantile.

I first saw him on the 18th. June. when a well marked papular eruption was already out on the face, arms & legs. He told me that three days previously, on the Sunday, he had burned

very sick but did not vomit - was
shivery & cold - complained much of
headache & general malaise feeling that
his legs could hardly carry him about.
At the same time he was conscious of
being very feverish & restless - He "knocked
about" in this condition till the Tuesday -
2 days after onset - when he began
to notice the little shotty papules, first
on the wrists & then on the face -
On the Wednesday I saw him & found an
abundant crop of papules which were
now spreading to the arms & lower
extremities: There was not much fever
& apart from headache & some pain
in the back the patient did not com-
plain of much. Indeed all through
this case although one of the severest
of the discrete form the general symptoms
were never very severe: appetite never failed:

there was no delirium, & no secondary fever to speak of. The rash followed a typical course. By the Friday & Saturday the papules had risen well out, enlarged, deepened in colour & the umbilicated vesicles began to form. There was no thickening or swelling of the intermediate skin; & when the pustules formed, though very close on the face & arms, they remained discrete. In a few days they began to dry up & the dark scabs to form, while in a week or so the crusts were beginning to fall off. In about three weeks all were off & he was dismissed.

The second group of cases comprises:

6. W. Leod
7. Shields
8. Mulholland
9. Mackay

These occurred as before indicated in a hut 10 miles from that in which the first cases arose & from a totally different source -

Case VI.

Roderick M^d. Leod - 44 - Navy

called to see him on 22nd. January & found him suffering from usual symptoms: high fever, rapid pulse, vomiting, severe pain in lower part of back, anorexia, thirst &c. In addition he had severe cough & a well marked papular eruption had already appeared on his face and wrists - He had first felt ill on the 19th. 3 days before & the rash had commenced to come out on the day previous to my seeing him i.e. 2 days after the onset: he had been in his usual health up to the time of the seizure - In a day or 2 the rash became much more abundant - spreading downwards over the body & extremities; & as the case went on it developed into the

Semi-confluent as in Case I. The period of maturation was strongly marked though the delirium was never great. When the pustules began to dry up & the intervening skin to recover he was literally covered with the dark crusts - These, however, began gradually to separate off, but convalescence was in this instance greatly prolonged. On the soles of the feet the thick crusts were so embedded that they had to be scooped out. Abscesses also formed under the thick skin in this region & had to be opened up & washed out with carbolic. Finally he made a fair recovery & was dismissed on 7th March. This patient like case I had never been vaccinated.

Note I have recently seen this man (October) though suffering from no definite sequelae he has been very weak & useless ever since.

Case VII

Charles Shields - 49 - Navy.

While seeing case VI on the 23rd. Jan'y.
my attention was directed to this man -
He had taken ill somewhat suddenly
on the previous day, I was suffering from
high fever, severe pains in head & back,
& other symptoms characteristic of an on-
coming attack of small pox - I removed
him on the following day, along with the
other, to my hospital hut. His
symptoms rapidly grew much worse,
delirium set in, the temp. rose to 105°
& the pulse became very rapid. He
complained of great nausea & constant
thirst, I was exceedingly restless -
On the 25th. the eruption began to come
out on the face & neck ~~and~~, rapidly
spreading to the arms, trunk & lower
extremities; the skin also becoming

much reddened & inflamed. In this case there was not, as in others, much diminution in the previous symptoms as the rash came out. The skin got more thickened & swollen as the papules changed to vesicles; & finally as the pustules began to form the whole surface of the body seemed enlarged & of a dusky red hue; while as the pustules broke they coalesced freely over the surface - They invaded the mouth, nose & conjunctivae, & caused the patient much uneasiness. Purulent discharge came freely from the nose while there was constant dribbling from the mouth, with coughing & ejection of purulent matter. The Lips & eyelids were much swollen, the latter could not be opened, & the effort to take even liquid nourishment was attended with pain & difficulty in swallowing; the breathing

rapid & laboured. As the case went on crusts formed but these were large, thick, irregular, of a dirty yellow colour with pus welling up from their edges. The patient seemed now incapable of much movement but lay on his back breathing hard & unable to open his eyes or form his lips to utter any words. At times he lapsed into delirium of a low muttering type & gradually became more & more comatose. He died on the 13th. day after the onset.

Case VIII & IX

Patrick Mulholland - 56

Duncan Mackay - 44

These 2 men walked into my surgery on the 8th. Feb. They had been vaccinated by me about 14 days previously on the outbreak of small pox in their hut & had been isolated. They now came to ask if they might rejoin the squads with which they

had been working before. On examining
the men closely I discovered about half a
dozen papules on Mackay's chin & neck, &
one or 2 also on Mulholland's neck -
Mackay confessed that he had felt out
of sorts for a day or so & was rather
feverish; he had had a little pain but
not much. Mulholland declared himself
to be all right - I conveyed both men
to the hospital hut. In both instances the
papules referred to increased in size, &
pursued the regular course but never really
became ~~pustular~~ ^{vesicular}; they seemed just to
fade away before that stage was reached -
A few more appeared about Mackay's legs
but neither these nor the others ever scabbed -
The other symptoms appeared & the patients
were practically well in a few days -

The difference between the cases of these
2 men & the other two - Shields & M. Leed
who had been removed from the same hut

The two cases not occurring in the
nuts.

Case X. Miss A. D.

- XI. Isabella Morrison

a fortnight before was very striking - Neither of the latter was ever vaccinated; the one developed the confluent type & died, the other the semi-confluent passing through a protracted convalescence. Mulholland & Mackay, on the other hand, well vaccinated were but little disturbed by the disease - This matter will however be referred to more fully later on.

Case X

Miss A - D - 27.

Called to see her on the 8th. Jan'y. She said that for a day or so she had been feeling languid, headachy & out of sorts, but being troubled with this sort of thing she paid no attention. On the night previous, however, she became more acutely ill, & had to go to bed. She complained of great heat, with severe pain in the head & back, & a dull aching of the limbs; nausea but no vomiting. She could eat

nothing & felt very restless & ill. I found her temp. to be 103.5° , pulse rapid, no cough, condition of lungs & other organs good, profuse perspiration. On visiting next day I found the condition much the same, but knowing that she had been exposed to small-pox infection precisely 13 days before I made careful examination & discovered one small but very distinct papule on the front of the chin. The following day this one showed still more & there was quite an abundant crop over the chin neck & forehead, more sparsely on the body but thicker on the forearms. The temp. had fallen to 100.5° - the pulse slower, pain almost gone. The disease after this followed the course of a mild type, the rash though very abundant, remained discrete. It invaded the trunk & extremities in due order the individual units becoming vesicular & enlarging as the days went on. The period of

maturation was well, though mildly marked; the temp. which had been practically normal from the outbreaking of the rash rising to 101.5; there was slight delirium during one night & the other general symptoms were more pronounced - On the 8th. day the pustules began to dry up & scab, those about the chin & face first; the skin around took on a more healthy tone & all traces of the inflammatory process quickly disappeared. The temp. dropped to normal, the pulse became natural & appetite returned. In due course the scabs began to separate & drop off, those about the feet being the last to disappear. Convalescence was uninterrupted -

This case is interesting as being one in which the incubation period could be very accurately ascertained - The patient was exposed to infection only for a few minutes

¶ precisely 12 days thereafter came the onset, the rash appearing on the 14th. All the other cases where an equally reliable history could be obtained agreed accurately with this one.

Case XI.

Isabella Morrison - 11 -

Called to see her on 29th January - She had begun to feel ill about a week before, complaining of feverishness, great languor, sickness, loss of appetite, pains in the back & limbs &c. She was able however to go about the house & did not take to her bed until the day previous to my seeing her. The skin especially of the face was now covered with a dusky red rash just like that of measles, the spots & patches being larger & darker than what is usual in the ordinary papular eruption of small-pox. But there was nothing in the history pointing

specially to the former disease & some of the spots were already taking on a character more akin to the small-pox rash. As the case went on this character became more marked, the papules appearing distinctly separate & just as if pushing their way up through the other rash - These joined into vesicles & became pustules & as the latter dried up & the dark scabs began to form they assumed the typical appearance of the discrete form - During the formation of the vesicles & especially at the period of maturation there was pro- longed & very marked nervous excitement; but the patient gradually calmed out after the full development of the rash - The eyes also gave much trouble in this case from the formation of crusts along the margins of the lids - Further than this the case presented no peculiar features - Convalescence went on favourably - the crusts separating in due course - Patient was dismissed well.

One feature in this case deserves comment, i.e. the source of the infection. In all my other cases the history was very clear & the source well known; but this case occurred in a small group of ~~two~~ isolated houses, situated on the one side & 7 on the other side, 4 miles from the two centres of infection to which the other cases were referable. The house in which she stayed was situated, however, within about 100 yards of the graveyard where, precisely 12 days before the onset or 14 before the appearance of the rash the first man who died of small-pox had been buried. The funeral took place at one o'clock in the morning & the coffin had not even to pass the house in which the girl stayed, but a member of the family residing in the next house helped to lower it & fill in the grave. The corpse had previously been wrapped in a saturated carbolic sheet & every precaution taken

against possible infection to those who associated in the Burial. No one developed the disease ~~and~~ in the neighbourhood but this girl; and as I have never been able to discover any other source of I am forced to the conclusion that the infection must have been derived in some way from the funeral in question.

Treatment

Of the treatment of the above cases little need be said. With the exception of the rash uncomplicated small-pox requires none. The rash itself I treated early, whenever, indeed, the papules began to enlarge & become vesicular. For the most part I used Carbolic oil for this purpose & even in the worst cases I did not ^{feel} ^{to any extent} the foetid odour mentioned in the Books. In one or two I used the Carrou oil with Eucalyptus & in my opinion this makes the most agreeable & effective application - It has a pleasant odour, relieves itching, & vastly adds to the comfort of the patient. And even in cases where the face was almost covered with the dark crusts hardly a cicatrix could be detected - The surface was, of course, always sponged with tepid water before the application -

Sometimes I found that the rash lingered long after convalescence was well established,

about the soles of the feet; and in this situation also, abscesses were apt to form from the impediment offered by the thick skin to the free discharge of the pustule - The deep scabs, bluish black, beneath the surface I shelled out with a scoop; the abscesses were slit up, the loose skin clipped away & the cavities washed out with strong carbolic solution. A little soaking in hot solution at intervals for a few days rendered the feet perfectly pure & so materially shortened the period of detention after convalescence. Complications had, of course, to be treated as they arose, but in the cases I have given there was little call for anything special - Stimulation I generally found to be necessary a few days after the maturation of the rash, in some cases, indeed, very free stimulation owing probably to the class of men to which most of my patients belonged.

It has been suggested that as the pustules formed they might be punctured & swabbed out with pure carbolic. This I found to be either unnecessary from the mildness of the case or impracticable from its severity -

With regard to the question of Vaccination & Small-pox as illustrated in the above cases I should like to give the particulars with respect to one hut, viz. that in which the second group occurred. I was able to watch this hut from the very beginning; it was completely isolated from the surrounding district: no men were permitted to enter it & none to leave it. The water supply came from the hill & all food was left at some distance - Infection was, in the first instance, carried to this hut by

a tramp who had stayed here for a few hours
on his way from Ardencaple to Brian Parish -
Of the 25 inmates of the hut all with 2 ex-
ceptions had either been vaccinated at some
time or other, or had had small-pox -
These two, M^o. Leod & Shields developed the
disease; M^o. Leod the semi-confluent type,
with exceedingly severe symptoms & prolonged
convalescence, Shields the confluent type and
death. On the occurrence of these 2
cases I made a complete examination of all
the other inmates as to vaccination and
then revaccinated all of them with the
exception of 5 who had previously had small-
pox - Of the 5 who had previously had
small-pox I noted the following particulars
at the time: - and it is a very noticeable
& significant fact that of these 5, four
had been totally unvaccinated, & one
very imperfectly vaccinated -

- (1) John Docherty - 56 - Small. pox 30 years ago - never been vaccinated.
- (2) John W. Grimmond - 40 - had small. pox 15 years ago - never been vaccinated.
- (3) Wm M. Connal - 50 - no mark - had small. pox 30 years ago -
- (4) James Campbell - 53 - had small. pox 21 years ago - never been vaccinated.
- (5) Mrs Jane Campbell - 51 - had small. pox at the age of 8 - attack very mild - one small mark infantile.

So that including Shields & M^o. Level the whole number of unvaccinated persons in this hut was 6. Of these 4 had previously passed through the disease & 2 contracted it in its severest forms at the very beginning of the epidemic.

All the other inmates had now been re-vaccinated, but 2 of them, Midebay & Mulholland, had already contracted the disease from the other

2 just mentioned. Mackay had been vaccinated in infancy & the present result was modified: ~~Mulholland~~ in the case of Mulholland the revaccination failed, but he had 2 good marks infantile. These 2 men then, developed small. pox of an exceedingly mild type - they were hardly ill at all - little fever or general disturbance - rash abortive. The others escaped.

In the other hut where ^{small. pox} ~~the disease~~ broke out the disease showed the same selection - The five cases which occurred there I have detailed above with notes as to their vaccination. It will be remembered that North Senr. was wholly unvaccinated - sickened first - semi-confluent type & death; Hannigan, Graham & Casey, all revaccinated, had the disease in an aborted form; while North Junr. though well vaccinated in infancy refused revaccination & though the disease was of the discrete ^{form}, it was very severe.

Miss A - D again had only one small mark infantile; & Isabella Morrison, though undoubtedly vaccinated had no mark at all.

The numbers are, in this instance, too small to form the basis of a general argument in favour of vaccination & revaccination as a preventative against small-pox, but to myself they are very conclusive - simply to see these few cases - watch their progress - note the development & effects of the disease in the different individuals, was enough to force on one ~~the~~ a strong conviction of the efficacy of vaccination & revaccination.

The General Administration of an epidemic such as that given above, in a rural district 40 miles from the nearest hospital accommodation is attended with many difficulties. Finding proper ^{or} accommodation for the patients, the nursing, provisioning,

isolation of suspects & those who have been in contact, & the care of the general community, have all to be anxiously considered. In this instance, fortunately, the first case arose in a hut, convertible with a little trouble, into a hospital; & a neighbouring hut was got for isolation purposes - The hospital was equipped with the necessary bedding, utensils, &c. - a nurse was procured, & an ambulance waggon for removals was sent by the sanitary authorities. The railway contractors, at my request, issued an order forbidding all hut-keepers to admit any strangers, & the gangers were instructed to take on no new hands; and any man who left a hut, left the works altogether & would not be again employed. It is the habit of railway navvies to work for a certain time in one place, & then go on to some other place, apparently for no better reason than the desire of change.

They have no ties whatever binding them to any one spot & when the fit seizes them they put together their small stock of belongings & "go on tramp". Sometimes they will pass from one part of the Works to another, sometimes go on to other Works miles distant, or take a longing for the City. There is thus a constant to & fro movement going on between such neighbourhoods, & between common lodging houses in the city & the crowded railway huts. It is in this way that small-pox is mainly spread; & here in Scotland, & from all parts of England we hear the same story of the "tramp-spread disease". But it very quickly becomes known among them - even to far distances - that no new men are being taken on at a given place, & they very soon cease to come if they are given to understand that there is neither work nor shelter for them. As a matter of

experience hardly a tramp was to be seen in this neighbourhood a week after the Contractors' edict had been issued, & all coming & going between the huts was soon stopped. At the same time systematic revaccination was carried out along the entire line & amongst the general inhabitants, & was almost universally accepted - Even when the epidemic was pretty well stamped out, so long as the disease lingered in neighbouring towns we deemed it advisable to allow no new man to start work until he either consented to revaccination or satisfied me that he had been already sufficiently protected - Further, the men who had been exposed to infection i. e. who had been staying in the huts where the cases broke out were isolated & injected every day for a fortnight - This necessarily entailed great expense, as, of course.

they had to receive what would otherwise have been their wage. But the result amply justified the expenditure. At the same time all measures of disinfection were thoroughly carried out. By these various means then :- keeping an otherwise migratory population stationary, isolation, quarantine, sanitation & revaccination the epidemic was soon stamped out. The cases we had formed ~~practically~~ what was practically a first outbreak i.e. the actual first cases & those who were infected directly from them before separation. There were no secondary cases whatever either in the huts or in the neighbourhood unless perhaps the case of the girl who stayed near the graveyard can be regarded as such. Perhaps I ought also to mention that, at the beginning of the outbreak I obtained the services of a doctor to look after my private work, while I reserved

myself entirely for small. pox; & a room was kept for the sole purpose of changing & disinfecting clothing, either my own or that of the sanitary officials whose duties brought them in contact with the infection. These last matters may seem almost trivial, but though we depend for the most part on revaccination as a preventative every detail of sanitation is of the utmost importance. It is at least satisfactory to note that the hospital was closed on the 24th. March & no fresh case has since occurred.

Vaccination & Small. Pox.

After the experience of the recent epidemics in Britain towards the close of last & in the beginning of this year, & the overwhelming evidence which came from all parts of the country of the protective influence exercised by vaccination & re-vaccination, it is almost unnecessary to make any lengthy comments on these points. The universal opinion of all those who have had anything actively to do in combating the disease is the same & has been well expressed by Dr. Russell of Glasgow. "After closely observing over 1000 cases of Small. Pox in hospital I have become deeply impressed with the helplessness of medicine when faced to face with the unmodified disease."

When a case presents itself, the first question in prognosis is regarding vaccination. If vaccinated then the attitude is one of hope that the disease may be cut short, however bad present appearances are, though, in fact, the probability is that the symptoms are from the first trivial. If unvaccinated then the attack will probably be severe, the eruption copious or confluent, & we recognise a virulent & deep constitutional disturbance against which the resources of medicine are powerless. As regards the individual the opportunity for medical interference is past, & we can only turn his case to profit by following on those about him the practice from the neglect of which he suffers."

The general result of the introduction of vaccination may be stated as:

- (1) diminished liability to attack
- (2) diminished fatality in those attacked.

These results are well shown in Dr. Smith's Barry's Report on the Sheffield epidemic of 1887-88.

Taking all ages:

Of 268,397 vaccinated persons, 4151, or 1.5 p.c.
took small-pox

Of 5,715 not vaccinated, 552 or 9.7 p.c.
took small-pox

Of the former 1 in 1300 or 0.07 p.c. died

" " latter 1 in 20 or 4.8 p.c. died

Thus the vaccinated enjoyed a 6-fold immunity from attack & a 68-fold security against death as compared with the unvaccinated.

Again taking an analysis of persons living in houses invaded by small-pox -

All ages :

Of 18'020 vaccinated 4151 or 23 p.c took the disease
" 736 not " 552 " 75 " " " " " " " " " "

Of the former 1.1 p.c. died

" " latter 37.2 " " " " " " " " " " " "

The vaccinated here enjoyed a 3-fold immunity from attack & a 33-fold immunity from death when attacked.

Further if we take the fatality of Small. pox - & this is also a good indication of the incidence of the disease - the figures are very striking -

England. In England during last century, the death rate per million of the inhabitants has been computed to be about 3000. After the introduction of vaccination in the present century the mortality has steadily diminished :

thus -

| | | | | |
|------------|----------------------------------|----------------|---|-----|
| From | | Yearly average | } | 417 |
| 1839. 63 - | Vaccin ⁿ . optional - | of deaths | | |
| | | per million | | |
| 1854. 71 - | vac ⁿ . enjoined - | " | | 154 |
| 1872. 90 - | vac ⁿ . enforced - | " | | 99 |

To quote from Dr. Seaton's Report to the Local Government Board on the Epidemic of 1871 - "The epidemic may have been useful in reminding some, although no one who had practical knowledge of Small-pox could ever have doubted, that the disease, uncontrolled by vaccination is at the present day exactly the same disfiguring & fatal disease which, in the last century, destroyed on an average 3000 persons annually out of every million of our population; & which at that rate would now, but for vaccination, be causing in England alone an average annual mortality of nearly 70,000."

And this too, not taking into consideration the extra facilities for infection on account of the constantly increasing aggregation of population in towns & cities & the enormously extended means of communication, between place & place.

Scotland.

In the case of Scotland, the Vaccination Act came into force from Jan'y 1. 1864. During the period 1864-71, inclusive, vaccination was well enforced & the Registrar General's returns show that 96.385 p.c. were successfully vaccinated. If vaccination there, be a protective, the fact ought to be well shown in children coming within this period especially as it includes the great epidemic of 1871. What is the result? * Up to the age of the Compulsory Law the average annual deaths from small-pox in Scotland among children under 5 years of age constituted

74 p. c. of the whole mortality from that disease, there being scarcely any variation in the average from year to year. But gradually, from the year 1864 onwards, as the law began to tell on the young population, this high percentage was reduced, first to two thirds, then to less than one half, till at the end of 7 years, in 1871 when the recent epidemic broke out the proportion which the deaths under 5 years of age bore to the total deaths from small-pox had become considerably less than one fourth - was in fact not only much more than one fifth."

Taking 8 towns in Scotland the Registrar General thus comments on the results of 1871 "If the same general mortality had taken place among children at that age - under 5 years - as occurred during the previous epidemics when they were less

X. I don't understand these figures as here given. No dates are given, and as a matter of fact I believe that compulsory vaccination has existed in most of the places named much longer than in Scotland. All this would need to be made precise and accurate references given to the sources of information.

Note, also, that the dots inserted after the first numeral of four, in the opposite page, are most misleading for their resemblance to decimal points.

efficiently protected by vaccination, instead of only 362 children under 5 years of age having died from small-pox 3'370 would have died." For the whole

period of this epidemic comparing the 8 towns of Scotland with equivalent populations on the Continent, the small-pox deaths under 5 years of age per one million of all ages were: -

Scotland = 692

Berlin ... 3'448

Hamburg ... 5'717

Leipzig ... 6'200

Holland ... 6'455

} No compulsory
Vaccination law
at this time.

Ireland -

In Ireland a precisely similar effect was produced by the introduction of the Vaccination Act of 1863.

Sweden. In Sweden where reliable data can be obtained to a much more remote period the average annual death rate

per-million from small-pox was as follows

1774 - 1800 Before vaccination ... 2008

1800 - 1815 Permissive vaccination .. 631

1816 - 1885 Compulsory vaccination 173

No further examples of the efficacy of vaccination in general need be given.

We may now pass to the consideration of

Re-vaccination. Under this head indeed the enormous benefits of vaccination will become even more apparent.

And first, it is necessary to divide the incidence & fatality of small-pox into age-classes. Taking the table given by the Registrar General in the Report of the Royal Commission on Vaccination (1884) we find that, when vaccination was optional (1847-53) the deaths from small-pox under five years of age averaged annually 1617; when vaccination became obligatory but was not enforced (1854-71)

the annual deaths fell to 817; & when it was enforced (1872-87) they fell still further to 242. Similar results, though somewhat less pronounced are seen in the ages 5 to 10 and 10 to 15. But when we come to the age classes above 15, taking the same periods, the average annual death rate from small-pox gradually rises - So the fall in small-pox mortality took place exclusively in persons under 15 years of age & most of all in children under 5 years of age, in which class the fall was 85 per cent:

| | | |
|--------------------|--------------|---------------|
| From 5 to 10 years | the fall was | 64 p.c. |
| " 10 " 15 | " " " | 27 " |
| " " " " | " " " | 25 |
| " " " " | " " " | 25 |

On the other hand from:

| | | |
|----------|--------------------|----------|
| 15 to 25 | there is a rise of | 11 p.c. |
| 25 - 45 | " " " | 62 " |
| Above 45 | " " " | 113 " |

| Ages | <u>Unvaccinated</u> | Fatality |
|----------|--|----------------------------|
| | Cases per cent of population at that age | or death p. e. of cases |
| Under 5 | 6.5 | 57. |
| 5 - 10 | 36. | 34. |
| 10 - 15 | 38.7 | 35. |
| 15 - 20 | 29.8 | 63. |
| 20 - 30 | 10.6 | 62. |
| Above 30 | 2.4 | 57. |

Thus we see that with good primary vaccination the incidence & fatality of small-pox are enormously diminished in childhood; & it is only when the protective influence is beginning to wear off that the mortality increases. - This loss of the protective influence of vaccination is well seen when we divide the small-pox cases in the Sheffield epidemic into age-classes & we may as well put in at the same time the percentage table for the unvaccinated for the sake of contrast in general.

Vaccinated

| Ages | Cases p. c. of population at that age | Fatality or death p. c. of cases |
|----------|---------------------------------------|----------------------------------|
| Under 5 | 0.36 | 0.8 |
| 5 - 10 | 0.67 | 2. |
| 10 - 15 | 1.9 | 1.7 |
| 15 - 20 | 3.6 | 2. |
| 20 - 30 | 2.8 | 5.14 |
| Above 30 | 0.97 | 10.4 |

We see then from these tables that, whereas the percentage of deaths to the number of cases is in the vaccinated infinitely less than the similar percentage in the unvaccinated still, taking the vaccinated alone, this percentage shows a steady increase with the advance period. Thus in the vaccinated under 5 the fatality is 0.8 per cent of the cases, but above 30 it is 10 per cent.

Vaccination therefore, almost an absolute protection to children under 5 as regards both liability of fatality, & a pronounced protection against death all through life yet becomes less so as the years go on. To preserve the insusceptibility to the disease the protection must be renewed, i.e. revaccination should be performed about the age of ten. That revaccination will preserve this immunity - an immunity stated by Sir George Buchanan to be equal to a previous attack of small-pox - has been abundantly shown -

The only country where revaccination is compulsory is Germany. Their Act, which dates from 1874 makes revaccination compulsory during school age in addition to vaccination in infancy. It is here then that we must look for results. The mortality from small-pox gives a fair indication of its prevalence & in Germany (Edwards) :-

from 1816 to 1870 we find this mortality fairly steady the average annual mortality per ~~100~~ 100'000 living, lying between 15 & 20 or 15 & 25, rising during epidemic periods to 40 or 50 or even 60 :-

From 1875 onwards the influence of revaccination becomes apparent; the mortality now falls to, & has persistently remained at, a lower figure than any since the beginning of the century.

The figures are :-

| | | | | | |
|-----------|------|------|------|------|------|
| 1845-52 : | 3.6, | 3.1, | 0.3, | 0.7, | 1.2. |
| | 2.9, | 3.6, | 3.6, | | |

Contrasting this again with a neighbouring country such as Austria, the difference is very marked, the corresponding figures for that country being: -

1877 - 81 : 53, 60, 50, 64, 82.

Further after the great epidemic of 1871 - 82 in all cities there was a temporary decline in the small-pox mortality followed by a considerable rise - In German cities, as in Germany generally it has remained persistently at strikingly low figures -

Contrasting London with Berlin.

| | | | | | | | |
|------------|---|---------------|-----|------|------|-----|-----|
| 1870 | } | <u>London</u> | 30, | 242, | 53, | 3, | 1.6 |
| to 1874 | | <u>Berlin</u> | 22, | 632, | 138, | 11, | 2 |

| | | | | | | | | | | |
|------------|---|---------------|------|------|------|------|----------------------|------|------|----|
| 1875 | } | <u>London</u> | 1.3, | 20, | 70, | 38, | 12, | 12, | 61, | 11 |
| to 1882 | | <u>Berlin</u> | 5, | 1.8, | 0.4, | 0.7, | ^{0.7,} 0.8, | 4.7, | 0.4, | |

The same thing is seen when foreign armies are contrasted: The French & Austrian

Armies still suffer severely from small-pox with a considerable fatality; the German army is comparatively free from small-pox, & since 1874 there has not been one death.

To return to our own country very powerful evidence as to the efficacy of revaccination has been obtained from the epidemics of recent years. Such evidence is naturally most conclusive when based upon statistics of those most exposed to the disease — From the Sheffield epidemic we learn that

- (a) Of 161 attendants on small-pox cases, 18 had had small-pox previously; none of these were attacked. 62 were once vaccinated in infancy; 6 took small-pox, one died. 81 had been revaccinated, not one took small-pox.
- (b) Of 831 soldiers, all nominally revaccinated

12 took small-pox; one died. In all 12 revaccination had been unsuccessful -

(c) Of 372 police, 10 not revaccinated took small-pox - Then a general order for re-vaccination was issued after which there were no more cases.

Again it has been proved that of 734 nurses & attendants in the Metropolitan Asylums Board Hospitals there were only 10 who had escaped revaccination, & all the 10 took small-pox.

And from a report on those in practical attendance on cases of small-pox supplied to the Epidemiological Society, it is seen that out of 1500 attendants on small-pox in the hospitals, 43 contracted small-pox & not one of these 43 had been revaccinated -

Numerous other illustrations, all of a similar kind, might be given, but these will suffice - It is enough that all the evidence that can

be collected regarding revaccination only shows the same result - i.e. almost absolute immunity from attack, immunity indeed as great as a previous attack of small. pox can itself confer. During the recent epidemic constant testimony to this effect was borne by Medical Officers of Health all over the Country - From Manchester e.g. W. Falkner reports that for the year ending March 25. ~~of~~ out of 406 cases of small. pox only one occurred in a revaccinated person, & his revaccination dated back 37 years -

But it is needless to go into these. In all it is the same story of selection, a selection in which the only element of difference lies in the degree of vaccination. One need only look at the different occupants of the beds in a hospital ward to see the history of their vaccination written

in their various aspects. The re-vaccinated he will hardly see; & the well vaccinated, imperfectly vaccinated & non vaccinated will be exemplified in the varying types of the disease - To see even a few cases & to study the degree of their severity in relation to the efficiency of their vaccination & re-vaccination is enough to convince him for ever of the enormous power of this prophylactic - We can only conclude by hoping that re-vaccination, enforced in our Government services, and, of their own free will, largely taken advantage of by the public in general may very soon be made compulsory in all.

Yours.