

THE INFLUENCE OF SMALL-POX HOSPITALS.

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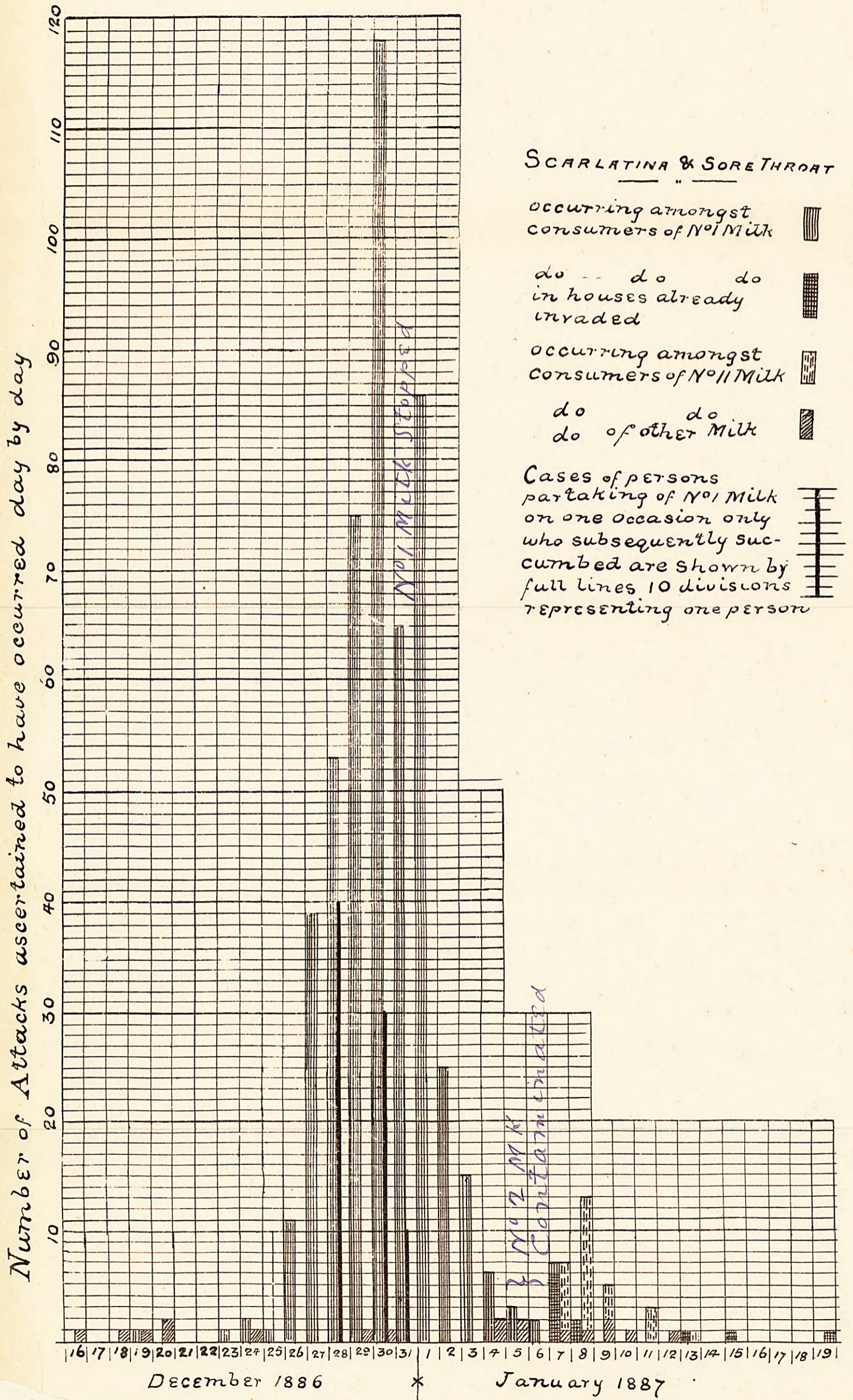
ABSTRACT.

THE reader commenced by giving a description, illustrated by photographs, maps, and plans, of the kind of hospital accommodation at Nottingham, which was situate quite in the heart of the populous part of the borough. It was of a temporary character, having been erected in a great hurry during the small-pox epidemic 1871-72. It consisted of wooden huts, capable of receiving eighty patients, built in a space of five acres of ground, and divided from frequented thoroughfares only by a wooden fence six feet high. The disadvantages of a hospital so situated and so constructed were obviously great. Much care and attention had been given by those who were concerned in the management, but with such materials it was an impossibility to carry out isolation in the perfect manner that should be expected at hospitals for infectious diseases. In the first place there was no suitable provision for a resident medical officer, who should be there to maintain a constant and intelligent supervision, and to exercise absolute and undivided control over the establishment and its inmates. Being also very centrally placed, some of the private practitioners continued attendance on their own cases at the hospital, and though most of them were very careful to adopt all requisite and practicable precautions, there were some who were not so. The chief drawback was due to the facilities for communication between the convalescents and persons outside over the wooden fence; and when the hospital was full it was exceedingly difficult to prevent this altogether. There was a further drawback to these hospitals, arising from the fact that the Poor-law Authority had a kind of joint proprietorship with the Sanitary Authority, which, at one time, seriously interfered with their proper medical management. It was evident, then, that hospitals of this temporary character, especially

when in the centre of a town, did not allow of isolation being carried out in a sufficiently complete manner. Having been convinced of this by recent experience, he had strongly urged the Town Council of Nottingham to build a permanent hospital away from the central part of the town, and they were at that time proposing to go to Parliament for compulsory powers to enable them to obtain a suitable site in accordance with the recommendations of the Royal Commission.

After dwelling on the great difficulty in tracing cases in town populations, the reader proceeded to give a narrative of the early part of the epidemic, which arose from cases imported into different parts of the town from Loughborough, London, and Derby, and elsewhere, accounting for all the cases which came to his knowledge during the first two months. With one exception, each of these admitted of being so dealt with as to allow little room for the spread of the infection. The exception to which he referred occurred during the fifth week of the epidemic. The symptoms of variola confluens, which was contracted in London, were manifested five or six days after arrival in Nottingham, and during the first few days of illness it was known that fifteen persons had been in contact with the sick person. This case formed a centre of infection situate in a direction north-east of the hospital, and at a distance of more than half a mile. He then referred to certain other cases which came to his knowledge about the same time, and which proved to be prolific centres of infection. One of these was at a little barber's shop. The mother and wife of the barber were attacked with the disease severely, and must have been lying within a few feet of where the customers were shaved. He had good authority, also, for saying that the barber himself suffered from a rash which was believed to be that of modified small-pox, his illness not being sufficient to prevent his pursuing his avocation. Another centre was at a tripe shop, where the person who nursed the patient also waited in the shop. A third, close by, was that of a man who refused to be removed to the hospital, and was afterwards found, with the crusts of small-pox upon him, conversing with people, for which offence he was prosecuted and fined. These three centres occurred within the quarter-mile radius of the hospital. There was a fourth, at a distance of about half a mile east of the hospital—an anti-vaccinator—who was discovered carrying on his business, as a journeyman tailor, whilst an advanced case of confluent small-pox (which he had kept secret) lay in a room which was virtually part of the

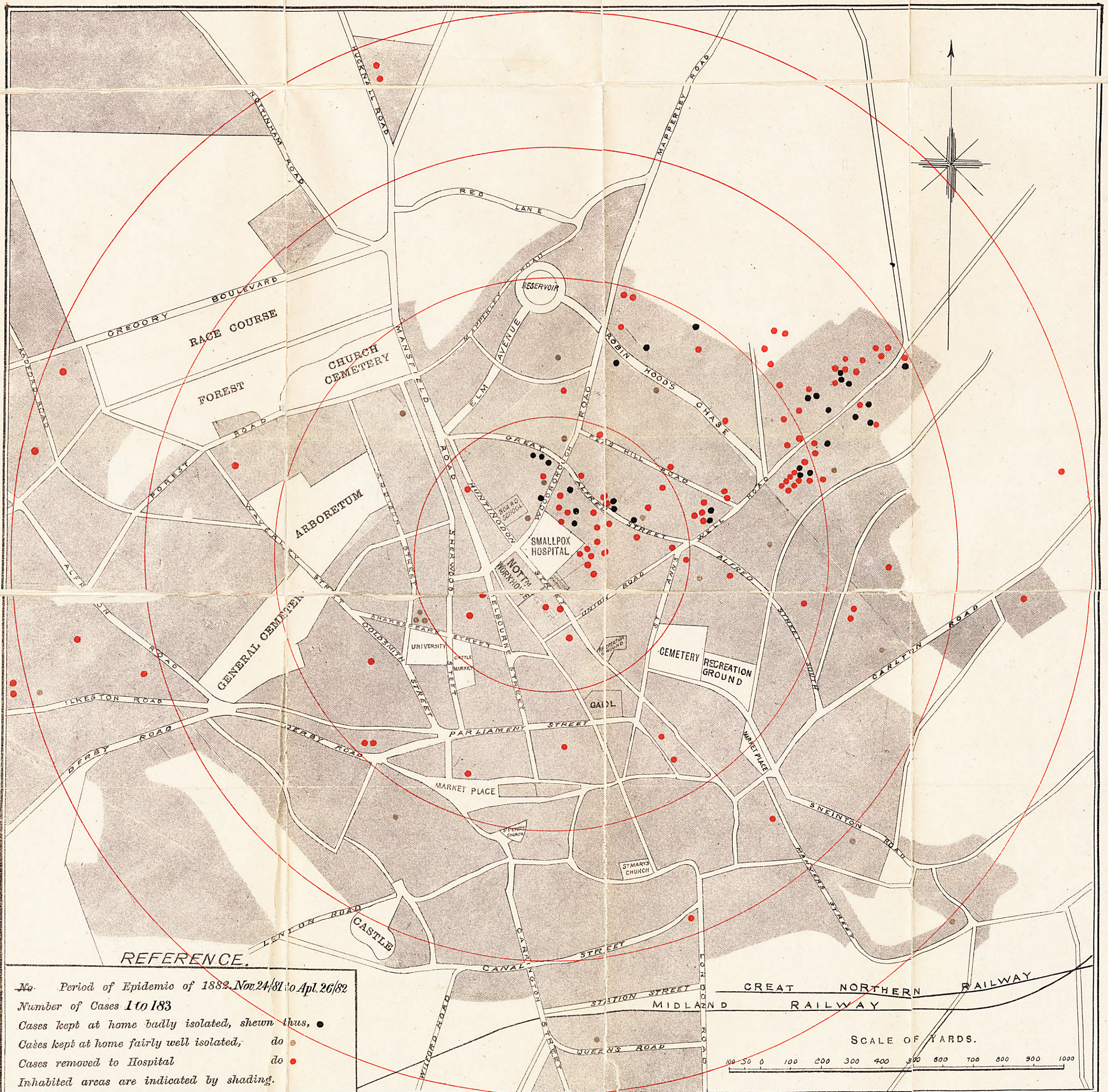
DIAGRAM SHOWING ATTACKS DAY BY DAY DURING EPIDEMIC AT WIMBLEDON & MERTON 1886 & 1887



A.—MAP SHOWING RADIUS OF ONE MILE AROUND

SMALL POX HOSPITAL,

NOTTINGHAM.



N.B.—Map A is the second in the series of seven maps relating to the epidemic 1881-1882.

The total number of cases in the period to which this map relates was 183, of which 150 appear within the area of the map. The dark spots standing alone to the North and North-East of the Hospital are seen surrounded by spots in the subsequent maps of the series.

workshop, and who thus became the means of disseminating the disease broadcast. This last-mentioned case, together with the other centre to which he had referred as having occurred during the fifth week of the epidemic, formed the starting-points of an outbreak a long way off, just as the barber's shop and the tripe shop must have been starting-points of the outbreak close to the hospital, on the east and north-east sides. This and other points he elucidated by a series of hand-maps which he had prepared, showing the gradual development of the epidemic. The maps showed the hospital as a centre, circles being drawn to indicate the quarter-mile, half-mile, three-quarter-mile, and mile radius. The cases were shown by spots of three different colours—dark blue, light blue, and red. The dark blue indicated those which were kept at home badly isolated; the light blue, those kept at home fairly well isolated; the red those removed to hospital. This division was of course somewhat arbitrary. The isolation was not equally bad in all the cases indicated by dark blue spots; and among the cases indicated by red spots were many which were promptly removed to hospital as soon as the symptoms of the disease were manifest; and others in which there had been opportunities for the spread of the disease before removal took place. Still, the different coloured spots served to indicate roughly the relation of cases. There were in all eight hand-maps. Five of these referred to different periods of the epidemic; the first, comprising cases 1 to 100, from November 24, 1881, to March 8, 1882; the second, 101 to 200, March 8 to May 1, and so on. Between the first and the second there was an intermediate map, A, showing the first 183 cases, November 24, 1881, to April 26, 1882. Then there was a map showing those of the whole 500 cases, from November 24, 1881, to November 7, 1882, which occurred within the mile radius. The eighth map referred to the epidemic of 1871-72. By the help of these maps a lesson might be learnt as to the value of an Isolation Hospital in checking the spread of small-pox. Taking Map A, which showed those of the 183 cases occurring within the circles during the first five months, it would be observed that they were mostly grouped near to badly isolated cases. A dark blue spot was almost always followed by a crop of other spots; on the other hand, red spots occurring in other localities stood alone. As he had already said, it would be seen from this map that the cases east of the hospital were arranged in two principal groups, which had relation to recognised centres of infection. These groups were separated by a broad belt of populous district, almost entirely clear,

with the exception of one little secluded terrace of houses, about which the disease hung for months. The relation of this cluster of spots to a blue spot as a starting-point seemed very evident. These groups—two large and one small—had occurred on the east side of the hospital, and the prevailing wind during the first five months of the epidemic was from the west. This had given rise to the supposition that the infection was carried in the atmosphere from the hospital as a centre; and in view of Mr. Power's admirable report recently made public, it was necessary to examine the facts closely to see whether they fitted in with this hypothesis. Apart from the relation of the cases to recognised centres of infection, there were other considerations which directly negatived this supposition. In the first place, the number of cases was greater in the group near to the half-mile ring, and between that and the three-quarter-mile ring, than close to the hospital. In the second place, there had been no simultaneous outburst of cases, such as might have been expected had the semina of small-pox been widely scattered in a still active state amongst a population which was proved to be susceptible. He had five maps, on a large scale, hung in the room, showing the position of each case as it occurred, the date of its occurrence being also indicated by a number; every case thus appeared as it presented itself in point of time. He would not attempt to go through the various groups of cases which made up the epidemic; he would, however, select one group as illustrating the others. It was that in the little secluded terrace, and in houses immediately adjoining, already referred to. The cases recorded here, within a few yards of each other, were numbered 39, 44, 57, 68, 94, 99, 136, 153; the corresponding dates being January 30, February 8, 16, and 22, March 4, 8, and 29, April 3. Now, this little cluster formed, up to the end of the first five months of the epidemic, a small independent group between the two large groups. The whole of the circumstances pointed to the fact that they arose from direct or intermediate communication between infected and non-infected persons. On the other hand, the hypothesis of atmospheric dissemination required us to suppose that the small-pox material, in process of being conveyed by the atmosphere in an easterly direction to the locality at the extremity of the half-mile radius, passed over unharmed the belt of populous district which intervened between the two large groups, and showed a special affinity for this particular spot; and not only so, but that it should have given evidence of its power for mischief by attacking the persons living there at different

times. The opportunities he had of seeing the way in which the cases arose led him to attach much importance to these considerations. He then drew attention to a large map of the borough, into which glass-headed pins were stuck to indicate the cases in the localities where they occurred—the first 183 being shown by black-headed pins, and the rest of the five hundred by pink-headed pins. It would be seen that there were very few black-headed pins near the hospital on the south side—not so many as those beyond the mile radius, which indicated some of the very earliest cases of the epidemic. East and north-east of the hospital they were massed in groups as already described. The pink pins were pretty thick south of the hospital, and also plentifully interspersed among and between the groups on the east. It would be seen, then, that during the first five months the south side was nearly free from small-pox, but that subsequently it became invaded. To account for this, much importance had been attached to the direction and force of the wind, which was chiefly from a westerly direction till the end of March, and during April and May from a northerly quarter. But, independently of all other considerations which were entirely opposed to this view, there was the fact that though the wind blew sometimes from the north, the susceptible population near to the hospital on the south were more free from the disease during all these months than localities widely distant. Besides, according to recent observations, it was not windy, but calm, misty, foggy weather which was favourable to the dissemination of small-pox material; and, assuming this to be so, the difficulty was to explain the immunity of the south side, seeing that there were twenty-eight days recorded as calm, misty, or foggy, during the five months.

The reason for the exemption of this district seemed to him quite clear; it was this—that the few cases occurring south of the hospital within the quarter-mile, half-mile, and three-quarter mile rings, were promptly reported, and in every instance the official staff was successful in getting them removed to hospital. This was shown in map A, where the cases were all indicated by red spots. At the end of April a case of small-pox was imported into the district; it was kept at home throughout the illness. He drew the attention of the Health Committee to this case when it occurred. For certain reasons it could not be removed to hospital, and the isolation was about as bad as it could be. Three other unvaccinated children in the same house were subsequently attacked. Now, this group of cases at the end of April

constituted a prolific centre of infection on the south side, just as the barber's shop, in January, must have been the starting-point of much of the small-pox near the hospital on the east. He had told the Committee at the time that they must anticipate a spread of the disease in this direction; and during the summer, as the maps showed, a large proportion of the cases appeared on this side.

The reader then went on to describe the hand-maps further in detail. As a rule, the blue spots were followed by a crop of other spots, but there would be seen to be some exceptions to this rule. It would be remarkable if it were not so, seeing that they had in vaccination an influence controlling the spread of small-pox more powerful than that of isolation. Whenever small-pox made its appearance in a locality, the Sanitary Authority urged revaccination not only on the household, but on the neighbours. In order to facilitate this, lymph freshly taken from well-chosen cases was furnished to practitioners for the purpose of revaccinating those who required it, and who were likely to be exposed to infection; and where medical men had certified that the persons were not in a position to pay the fees for these revaccinations, the Sanitary Authority had, with a wise liberality, made it a rule to pay for them at the rate of 2s. 6d. each. Still, with all these arrangements, there was the greatest possible difference in the way in which vaccination was pressed by different medical practitioners, and this fact, of course, constituted an element of the first importance in determining the spread of small-pox. Then, again, independently of the way in which the desirability of vaccination was put forward by the medical attendant and the officer of the Sanitary Authority, the occurrence of a death from this terrible and loathsome disease would sometimes arouse the people of a neighbourhood to a sense of their folly in neglecting to avail themselves of vaccination. This was all the more so when the case was kept at home, and the people became acquainted with small-pox in all its hideousness, as it occurred amongst the unvaccinated or the badly vaccinated. This led him to speak of one disadvantage that attended the removal of the worst cases to hospital. It undoubtedly did tend to encourage that indifference and repugnance to vaccination which was so sedulously cultivated by anti-vaccinators, and which arose to a large extent from an ignorance on the part of the people as to what small-pox unmodified by vaccination really was. This constituted one of the disadvantages that to some extent counterbalanced the great advantages, from a public health

point of view, of the early removal of cases to hospital. In addition to the action to which he had already referred, he had himself, acting for the Health Committee, done what he could single-handed towards promoting re-vaccination. He had endeavoured to bring this about by addressing meetings of the working people at the factories on the subject, and, at the same time, providing exceptional facilities for good "arm-to-arm" vaccination, free of cost, at the factories. In some instances, being backed up enthusiastically by large employers of labour, he had succeeded in getting numbers of lace-girls over fifteen years of age, and other factory hands, revaccinated, and in this manner the progress of the disease must have been interfered with very much.

With all these disturbing elements, if he might so term them, it was not to be expected that the spread of the epidemic would be uniformly in proportion to the badness of the isolation, or that there should be any mathematical relation between the number of blue spots to the total number of spots in a given locality. Still, on looking through the series of maps, they would see that the localities in which badly isolated cases occurred almost always became the seats of a further outbreak. The exception to this general rule seemed to be most marked in the fourth map of the series, which comprised the one hundred cases occurring between June 12 and July 7, and also in the fifth, which comprised the last hundred, the most of which occurred in July. Here they had, in the season of the year, another important controlling influence, of a nature as yet little understood. For though during July and August nearly all the cases were promptly removed to hospital, there were a few outside, which at another period of the year would certainly have proved active centres of infection. He could not, therefore, ascribe to hospital influence more than a share in bringing about the almost complete cessation of the epidemic in September; though he was disposed to think that share was a very large one, having regard to the very large proportion of susceptible persons in the borough. Here he might ask—How was it that small-pox did not spread so rapidly at one time of the year as another? How was it that in one epidemic it would assume a much more malignant form than in another? How was it that measles, a few years ago, attacked Plymouth with such virulence, while at the same time the disease prevailing extensively amongst a population of presumably the same susceptibility, at Nottingham, caused a serious but comparatively small mortality? Why was scarlet fever so terribly fatal in Hull about a year ago? By the light of

present knowledge these anomalies could be only partially accounted for. The science of epidemiology had yet to solve these and many other mysteries. In the meanwhile, with regard to small-pox, this much can be said for certain, that it is practically preventable by vaccination and re-vaccination *properly* performed, if the people would only avail themselves of these safeguards. In isolation hospitals there is also another means of prevention, which, for various reasons, must, he thought, at the present day be considered indispensable.

The last map of the series showed the whole of the cases which occurred from November 24, 1881, to November 7, 1882, within the mile radius, in relation to cases kept at home as well as in their relation to hospital. It was important to note that, though the total number of cases appeared to show a relation to their distance from the hospital, they also bore a relation to the number of centres of infection within the four circles. The relation was not a definite one, and would not be expected to be so, for reasons already stated, but it was obviously a prime factor for consideration in determining the question of atmospheric dissemination.

He had not as yet had the opportunity of alluding to a very probable source of infection in some of the first cases which he had referred to as starting-points of the outbreak, near to the hospital. It arose from one of those very slight cases of modified variola which are best described as "ambulatory small-pox", and which, as we know, are so often fruitful sources of mischief in a way which, at present, it would appear impossible to prevent. The person so suffering, who lived near the hospital, and also close to where the subsequent cases arose, must have taken small-pox at the end of November or beginning of December 1881, when there was only one case of small-pox in the hospital. Unless it were supposed that this man contracted his illness from this one case through the atmosphere, he must have got it independently of the hospital, seeing that prior to November 24 it had not been used for small-pox for months, and then only for one case at a time. He was a joiner by trade, and was going about his work as usual whilst in a condition likely to give the disease to others. It would be seen, then, that even at the very commencement of the epidemic there was outside the hospital an independent source of infection, and that very erroneous conclusions might have been arrived at had it been overlooked.

The reader then proceeded to draw attention to certain remarkable exemptions, which could not be well accounted

for on the hypothesis of atmospheric dissemination. The west side of the hospital had been comparatively free from the disease, as compared with the south and east sides, and though it was possible that the population was better protected by vaccination, there was no proof that it was so. Then close to the hospital, on the west, was the union workhouse. The first case of the epidemic made its appearance here on November 24, it being removed to the hospital over the way at once. Whilst at the workhouse the patient was in the "skin ward", with fourteen others. Of these fourteen, seven contracted the disease. There were a few other cases which occurred at the workhouse about this time, and one person died there; but after the commencement of the epidemic, the workhouse, with its 618 inmates, was free from the disease, notwithstanding its close proximity to the hospital, and notwithstanding that there had been very little re-vaccination carried out. In May, another case or two having occurred, re-vaccination was extensively resorted to. On the other side of the road, on the north, is a large board-school. In the boys' department, which is nearest the hospital, there are 410 scholars; two of these only were attacked, and in each there was ample opportunity for the illness to have been contracted in the ordinary way. This immunity, however, did not count for much, seeing that primary vaccination would protect the vast majority of those at school age, and it would be only those who had escaped vaccination who would constitute a test.

But by far the most remarkable case is that of Mr. Hodgson's factory, on the south side. This building is virtually in the hospital ground, the distance being only thirty yards from the nearest hut to the factory wall (photographs shown). Some of the windows on the second and third floors overlook the hospital ground, and a stone might easily be pitched from one of the "doubler's" rooms into one of the hospital huts in which some of the worst cases were put during the epidemic. The factory buildings, however, are enclosed in such a way that there can be no personal communication between the workpeople and the hospital convalescents. During the year two persons working at this factory had been attacked. In one case the source of infection might be said to have been traced with a considerable amount of probability; in the other, it would be quite impossible for anyone to ascertain with anything like certainty the various chances of infection incurred twelve or thirteen days prior to the commencement of illness. When he visited this factory a short while before, it was for the purpose of

finding out whether there were any persons who had not been re-vaccinated. The factory was not one of those at which he had himself addressed the *employés*, but, having regard to its very close proximity to the hospital, and to the danger which was supposed to exist in consequence, he fully expected to find that nearly everyone was protected against small-pox by re-vaccination. To his great astonishment he found that (excepting the Messrs. Hodgson) so far from being the rule, re-vaccination had been the rare exception; that a large number of the workpeople were very badly vaccinated, and that some were unvaccinated. In order to show the proportion of persons who might be looked on as susceptible to small-pox, he had drawn up the following table. In separating the vaccinated but unrevaccinated adults into Classes II and IV, he had been guided not only by the number and size, but also the character of the marks as regards their foveated and depressed condition. This division was, of course, somewhat arbitrary; some of those placed in Class IV might by others have been placed in Class II, and *vice versâ*; but he had tried to represent the facts as fairly as possible.

Now, the number of patients at the hospital huts was at one time as many as seventy-eight. The proportion of acute cases was, of course, constantly varying, but in one week there were as many as thirty-two fresh cases admitted. At the lace factories the work is carried on at night as well as in the daytime. During the eleven months the "hands" must have been working there under every conceivable variation in atmospheric conditions. They were there during the still, cold, foggy weather of December and January, during the early spring, when the high winds blew from the west, in the hot days of June and July, in the still summer evenings, and again in the early morning when the dew was rising from the earth. They were there in damp and dry states of the atmosphere, when the amount of ozone, according to Schönbein's test, was present in large quantities, and again when it was absent; when the electrical condition must also have varied, when the wind was from the north, the south, the east and the west. Had fourteen of these forty-eight persons been for twenty-four hours in the "skin ward" with a case of small-pox, as the people were over the way on November 24, it is highly probable that, as had happened then, about half of them would have contracted the disease. On the hypothesis of aërial infection, and having regard to the close proximity of the hospital, it is certainly very difficult to account for the immunity of these forty-eight persons during the whole epidemic.

HODGSON'S FACTORY.—*Date of Examination, November 13th and 14th, 1882.*

Number of persons examined as to vaccination, 113.	} 3.	} 1.	Number of persons employed during whole epidemic	{ November 1881, to November 1882	{ 90.	
" refused to be examined, 4						Said to have good primary vaccination
Total number employed at date of examination, 117.					{ Since September 1, 1882 ...	{ 7

Total number employed during whole or chief part of epidemic, 110.

Of the 90 employed during the whole time.		Of the 20 employed during the chief part.	
(a.) Completely or partially protected, 51.	(b.) Unprotected or very slightly protected, 39.	(a.) Completely or partially protected, 11.	(b.) Unprotected or very slightly protected, 9.
CLASS I.—15. Adults revaccinated; under 15, with good marks.	CLASS IV.—34. Adults with bad marks.	CLASS I.—5. Adults revaccinated; under 15, with good marks.	CLASS IV.—6. Adults with bad marks.
CLASS II.—27. Adults with moderately good marks; under 15, with evidence of vaccination.	CLASS V.—5. No marks, unvaccinated.	CLASS II.—6. Adults with moderately good marks; under 15, with evidence of vaccination.	CLASS V.—3. No marks, unvaccinated.
CLASS III.—9. Previous attacks of small-pox.		CLASS III.—0. Previous attacks of small-pox.	

Total number working in the factory during whole or chief part of epidemic, 110.

(a.) Completely or partially protected, 62.	(b.) Unprotected, or very slightly protected, 48.
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In conclusion, the reader exhibited a map which showed the localities in which all the fatal cases occurred during the epidemic of 1871-72. It was impossible for him to do more than this, as, of course, at that time there was no registration or notification of cases of sickness. It would be understood, therefore, that this map had not the same signification as those he had previously laid before them; still it was a very remarkable fact that the deaths from small-pox, which he had indicated by black spots, were chiefly aggregated in localities far removed from the hospital, the immediate vicinity of which, especially on the north and east sides, was remarkably free. This quite coincided with the facts given by Dr. Thorne (*Report of the Medical Officer, Local Government Board*, 1882, page 210), and with the very important statements there recorded of Mr. Burnie and Dr. Bury, medical gentlemen who practised in the neighbourhood at the time, which went to show that though the hospital was fuller during that epidemic than it had ever been on this occasion, there was less small-pox in the neighbourhood than in other parts of the town.
