Memorandum by Dr. R.J. Reece on considerations adduced by Dr. Hope in reference to a report by Dr. Reece on smallpox and smallpox hospitals at Liverpool, 1902-3 / Richard J. Reece.

Inter-departmental.

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Memorandum by Dr. R. J. Reece on considerations adduced by Dr. Hope in reference to a Report by Dr. Reece on Smallpox and Smallpox Hospitals at Liverpool, 1902-3.

At the desire of the Board I submit comments on the observations of the Medical Officer of Health upon my report to the Local Government Board on Smallpox and Smallpox Hospitals at Liverpool, 1902-3.

Dr. Hope, in his report to the Liverpool Corporation on "The recent outbreak of smallpox in Liverpool," dated 31st December, 1903, stated (p. 28) :—

> "Until within recent years there was an impression that a smallpox hospital, "however well conducted, must necessarily be a source of infection to the district in "which it is situated, owing to what is known as aerial convection, *i.e.*, conveyance of "infection for prolonged distances through the atmosphere. It is important, therefore, "that the experience of the Liverpool hospitals in this respect should be borne in "mind, because it shows that in strictly disciplined institutions, placed as these hospitals "are, no danger arises from this source."

And in February, 1904, Dr. Hope tendered evidence in a Court of Law to the same effect.

Thus, Dr. Hope had already, before my inquiries were begun, denied the existence of spread of smallpox round Liverpool hospitals due to aerial convection, and had also stated that the administration of the hospitals had been successful in preventing the spread of the disease from them by other means.

An opinion has sometimes been expressed by those engaged in public health work, that the Medical Department of the Local Government Board should investigate the circumstances of a case in which it is believed that a hospital situated in a populous district and used for the reception of acute smallpox patients during a considerable epidemic, has exerted no adverse influence on the population in its neighbourhood. The Liverpool epidemic of 1902-3, in view of the statement above quoted, seemed to offer such a case ; but the first requisite was knowledge of the facts. It was into the facts that I was instructed to inquire, and in particular whether there had been any excess of incidence, as regards smallpox invasion, upon houses situated around the several Liverpool hospitals which had been used for smallpox, during the periods in which those hospitals received smallpox patients.

The result of my inquiry is set forth in my report. By the publication of the facts obtained by my inquiry, Dr. Hope appears to have been placed in the position of having to accept my conclusions as to the existence of "hospital influence" in Liverpool unfavourable to the health of that City, and acknowledge that he had been hasty in 1903, or of attempting to explain away the facts established by my inquiry, so as to justify in some measure statements in his report of December, 1903. It is necessary to point out that he had not worked out prior to the publication of that report the data which were absolutely essential before any pronouncement could properly be made on the question of hospital influence. I have now supplied these data, and Dr. Hope cannot find fault with my facts, for my report is little else than a collection and an ordering of facts which were supplied me by Liverpool officials.

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Dr. Hope's position would have been stronger, in my judgment, if he had frankly admitted that a series of important facts had been obtained which were not before him two years ago. Many of his present observations, it appears to me, go wide of the main issues involved. It is beside the mark, for instance, to suggest, without warrant, that I accuse the Liverpool Hospitals' Committee of negligence ; that I "complain" of various things ; that there is a difference of opinion between my official Chief and myself, and that I condemn the Fazakerley hospital site for the treatment of smallpox. And on the main question Dr. Hope has, I think, failed to reconcile the facts of my report with the view that none of the Liverpool hospitals exerted an adverse influence on their neighbourhoods, either by aerial convection of smallpox or by hospital maladministration. To this I revert below.

It will be convenient now to refer to the ten numbered "conclusions" attached to Dr. Hope's "Observations."

"CONCLUSIONS.

"1. On the whole the observations of Dr. Reece relating to the administrative "arrangements are indicative of an absence of practical acquaintance with the sanitary "administration of cities.

"2. This is further shown by his general reflection upon the supervision of the whole "of the City hospitals ; but in this latter case he might with but little trouble have "visited these institutions, or at least, by making inquiries concerning them, have made "himself acquainted with the methods of their supervision.

"3. The conclusions in the Report are based altogether upon a limited aspect of the "geographical distribution of the disease. No other aspect of the question has been taken "into consideration, and the geographical one to only such partial extent as will enable it "to invest the conclusions with an appearance of accuracy.

"4. Spot maps, and tables compiled from them, are alone relied upon. The futility of "basing conclusions upon spot maps and tables compiled from them alone, is illustrated by "a comparison of the smallpox incidence in the Parkhill Hospital area with its incidence in "the Netherfield Road Hospital area. The two cases are practically parallel so far as "geographical incidence is concerned. The gradations in the incidence of the disease are "remarkably similar, and as a basis of statistical argument, the case of Netherfield Road "Hospital is a much stronger one than Parkhill, because the observations extend over a "longer period, viz., twenty-three months as compared with six months, and relate to a "considerably larger number of houses.

"5. But there is no reason to assume that Netherfield Road Hospital, which was not "used for smallpox at all, could have been a source of smallpox infection to the neighbour-"hood. The presence there of smallpox was due to other causes—the same causes, in fact, "which gave rise to it in the neighbourhood of Parkhill.

"6. In both cases the prevalence of smallpox was due to causes wholly unconnected "with either hospital.

"7. Referring to Priory Road Hospital, the spot maps themselves lend no colour to the "conclusions sought to be drawn from them. For more than an entire year the hospital was "in full use, and the whole population within a quarter of a mile of it lived in entire "security during that time.

"8. As the site for the Fazakerley Hospital is one which the Corporation, after due "deliberation and consultation with the Local Government Board, purchased for a smallpox "hospital with the sanction of the Board, questions affecting its fitness for the purpose are "of great importance. The cost of the Fazakerley Smallpox Hospital was about £60,000.

"But it is apparent that in dealing with this hospital the gravest mistakes have been "made by Dr. Reece. It is quite true that a table has been constructed which would ascribe "to the Fazakerley Hospital a most damaging influence upon the public health. The "allegation, however, rests on the invasion of two houses within the half-mile circle, with "an increase of house invasion in the zone more distant from the hospital. In the first "place, these figures are far too small to justify tabulation, and the table constitutes a "use of figures which is altogether misleading and improper.

"9. Neither the Local Government Board nor the Port Sanitary and Hospitals' "Committee could assent to the continued use of this institution if the allegations "contained in Dr. Reece's table are to be regarded seriously.

"It does appear that the sole object sought to be served by the table is to lend "colour to the preconceived view which is expressed at the outset of the report.

"The Port Sanitary and Hospitals' Committee will desire to be satisfied upon this "point, and will no doubt confer with the Local Government Board upon the matter.

"10. The Committee will, of course, appreciate that Dr. Reece's Report derived "its importance from the official position which he holds, and although it does not "appear that the Local Government Board have adopted the report, or have given "official acceptance to it, yet no doubt must be allowed to remain as to the views of "the Board and the views of the Committee in the matter.

E. W. HOPE."

In the first instance I may dismiss Nos. 1 and 10. No comment is needed.

No. 2.—As to what I state in my report on this matter, see pp. 6 and 7, where I mention certain details connected with the administration of the Liverpool hospitals.

I fail to see how a suggestion for a revision of the scheme of supervision can be construed as "suggesting negligence on the part of the Hospitals' "Committee of the Corporation." (Dr. Hope's Observations, p. 5, para. 4.)

However, Dr. Hope admits the correctness of my statement; and he himself points out "that this trouble is of old standing." (Observations, p. 5, para. 2.)

No. 3.—My report shows the topographical distribution of the invasion by smallpox for the City of Liverpool as a whole, and for the special mile areas around each of the three hospitals used at one and another period for the reception of acute smallpox patients. Also it shows period by period the *time* incidence of this house invasion. It is this latter point which is of special importance, as it shows that the opening of one or another hospital for the reception of acute smallpox cases was followed by special incidence of smallpox on houses in its neighbourhood.

No. 7.—In the quarter-mile area in question, there are only 85 dwellings, 80 of which are clustered together on one point near the circumference of the area. Escape of a small group of dwellings of this kind (one house only was invaded by smallpox in the whole period under consideration) does not prove the absence of "hospital influence." When the larger and more populous areas (the $\frac{1}{4}$–$\frac{1}{2}$-mile and $\frac{1}{4}$–1-mile zones) are considered, the excess of incidence of smallpox round this Priory Road Hospital becomes apparent.

Conclusions Nos. 4, 5, 6, 8 and 9, may most conveniently be taken together.

My main work at Liverpool was to get out the data, to apply all available means of checking and correcting the collected facts as to the occurrence of cases and the invasion of houses; to determine populations and numbers of dwellings in different areas; to spot maps so that they showed, fortnight by fortnight, all the newly invaded houses in the city; and, subsequently, to combine these various data as to local incidence of smallpox in relation to the hospital operations. In my report I summarise the questions with which I had to deal as follows:—

"1. Has the inhabited area, within a mile in each instance of hospital, suffered more severely than the rest of Liverpool? And, if so,

2. Has the exceptional incidence within that area corresponded in point of time (having regard, of course, to the period of incubation of smallpox) to the use of the hospital for the treatment of acute small-pox cases? And

3. Is there evidence that within the several "one-mile areas" as they may be termed, dwellings nearer to hospital sustained a heavier incidence of smallpox than those farther away?"

And my conclusions, based solely upon data as to the accuracy of which Dr. Hope and I are completely in accord—for obtaining many of them I am of course indebted to him and to his staff, were :—

"1. Inhabited areas with a mile of each of the three Liverpool smallpox hospitals have suffered more severely from smallpox than the City as a whole.

2. Exceptional incidence of smallpox within these areas has corresponded in point of time with the use of these hospitals for the treatment of acute smallpox cases.

3. Broadly speaking, within these hospital areas the dwellings nearer to hospital have sustained a far heavier incidence of smallpox than those further away."

The Liverpool experience summarised in the above conclusions is parallel to that met with in London before 1886, and subsequently in a plurality of other instances of provincial hospitals which have had considerable populations in their neighbourhood ;* so that with regard to Liverpool I drew the inference that it supplies a notable example of the "smallpox hospital influence" with which we have become familiar.

In drawing this inference I was of course alive to the consideration that the excess of incidence of smallpox within the hospital areas might have been due merely to the accident that undetected cases, or other causes of spread of smallpox from person to person, had occurred in exceptional number, as a result of mere chance, in the areas in question at the time when the hospitals were open. Considerations such as these might perhaps have required discussion in my report if the experience of Liverpool in 1902-3 had stood by itself. But having regard to the notorious occurrence of similar phenomena round many other hospitals in other epidemics "personal infection" could at once, in my judgment, be dismissed as altogether inadequate to explain the whole of the Liverpool facts.

Dr. Hope, however, appears to entertain seriously the suggestion that the whole matter was fortuitous. This seems to be his sole argument on the main issue. I understand him to contend that the Liverpool experiences are not instances of true "hospital influence"; that the excess of incidence of smallpox round Liverpool hospitals ; the correspondence of such incidence in point of time with hospital operations ; and the gradations observed, have had none but accidental relation to the hospitals themselves.

I do not think Dr. Hope has fortified his contention materially by citing instances where particular individuals living in the neighbourhood of a smallpox hospital probably contracted their smallpox as a result of direct personal communication with an antecedent case.

Of course scores of instances could be brought forward in which persons living near a smallpox hospital were in all probability infected independently of it. Living close by a smallpox hospital does not confer immunity from smallpox by direct infection—this point is indeed too elementary to need stating. The question at issue is not whether *all* cases living within a mile of a hospital contracted smallpox from the hospital, but whether the *exceptional* incidence round the hospital is attributable to the hospital.

It is worth noting also that the instances given by Dr. Hope are not particularly convincing. Thus in one series of cases his staff traced the source of infection of a woman (p. 18 of his "Observations"), "Annie Robinson, living at No. 14, Balkan Street (which is within 50 yards of Park Hill Hospital walls)." As a matter of fact there were no cases of smallpox in Park Hill Hospital at the time, and thus the tracing of the case is irrelevant to the issue. In another series (P.S. Diagram & p. 21 of his "Observations") he traces the infection of certain persons to a single primary case. But the

* References to the literature on the subject are given in a footnote on p. 9 of my report.

primary case in question was a patient who died suddenly at a house in the ¾–1 mile zone of Priory Road Hospital, at a time when this hospital was receiving acute smallpox patients, and the infection of this primary case is unaccounted for by Dr. Hope. It is also useful to recall that Dr. Hope stated quite recently at a meeting of the Epidemiological Society that he had succeeded, through the efforts of his staff and with the aid of special powers to which he has referred, in tracing a *probable* source of infection in "about 1,000 out of 2,082 cases," which occurred in Liverpool during 1902-3. There seems to be here in the balance "unaccounted for," ample margin for cases due to aerial convection from the hospitals. But there is also some question with regard to the 1,000 cases which he regards as accounted for. In some of these cases, occurring in the hospital areas, it appears to me after study of the detailed list that, after all, the recorded evidence of contact with smallpox cases was slight, and that it might at least be equally probable that aerial convection from the hospital was the real cause. This, however, can only be a matter for speculation. A further point to be borne in mind is the possibility (not recognised, of course, by Dr. Hope) that certain of the undetected cases which remained at their houses (in any part of the city) caused infection in their neighbourhood as a result of aerial convection, not of direct or mediate infection.

The Netherfield Road story does not seem to me to lend weight to the argument that the occurrences round the hospitals were merely fortuitous. The analogy is hopelessly incomplete. If it is desired to show by analogy that the occurrences round the smallpox hospitals were accidents and nothing more, there is wanted something of this kind: namely, a series of facts as to the incidence of smallpox round three establishments which are the only three of their kind in or near the city—say three skin hospitals, three piano factories, or three gasworks, provided they are in each case the only three—and are placed in different parts of Liverpool, and outside the smallpox hospital areas. If the analogy is to be of value there should be found an excess of incidence of smallpox round each establishment and a graduation of incidence round each establishment. And it would not be enough to find that this excess of incidence and this graduation occurred when the whole epidemic period was taken; in the case of establishment A, they must be found during the period in which Park Hill Hospital was receiving cases and not at other times; in the case of establishment B solely while Priory Road Hospital was receiving cases; and in the case of establishment C, solely when the Fazakerley Hospital was receiving cases. In the absence of some such demonstration, I do not see how to attach weight to the comparison to which Dr. Hope invites attention.

I find it somewhat difficult to follow Dr. Hope's criticism in regard to rates. The statistical part of my report was intended for readers who could distinguish between actual figures given and rates calculated on those figures, and throughout my report I have given the actual figures side by side with the rates. In dealing with the case of Fazakerley Hospital I have in three separate places drawn attention to the necessity of caution in drawing inferences from rates based upon small numbers (pp. 12, 14 and 15). The fact is, of course, that in my report some of the rates are calculated on large figures, *e.g.*, the rates for the more populous areas round Park Hill Hospital during the period (7th December, 1902, to 20th June, 1903), when that hospital was receiving cases on a large scale at the height of an epidemic; whereas others are calculated on small figures, *e.g.*, the fortnight by fortnight rates, as also the rates on the small area within ¼-mile of Park Hill Hospital, which contains only 171 dwellings, nine of which were attacked, giving the rate of 526 per 10,000 referred to by Dr. Hope. The smallness of the number of houses in such an area as this, or as the Fazakerley neighbourhood, is a matter which had to be taken as it was found. The point which comes out in dealing with the mile areas round these several hospitals and the sub-divisions of those areas is that whether there be taken the large figures for the large hospital (Park Hill) at the height of the epidemic, or the smaller figures for the smaller hospital

(Priory Road) in the early portion of the epidemic, or the figures for the outside (Fazakerley) hospital with comparatively few houses round it, each basis of consideration indicates in its degree and on the invasion rates, a like specialised incidence corresponding in point of time to the hospital operations. Furthermore, where the figures are largest, and the conclusions to be drawn from the rates are consequently the most definite, the indication of the excess of incidence, and the graduation of incidence, are clearly manifest.

It is reading into my report that which is not there to represent that I state distinctly there is only one explanation of smallpox incidence round hospitals, viz. : dissemination of infection by aerial convection, and that I ignore all the considerations upon which so much stress is laid by Mr. Power and other observers. Those who read my report carefully will see that it is limited, so far as prevalence of smallpox around the hospitals is concerned, to the three considerations set forth above, and that I offer no explanation as to the cause of this prevalence ; the statements in the report are strictly limited to observed facts.

My provisional attitude with regard to aerial convection of smallpox infection is set forth on pp. 9 and 10 of my report as follows :—

"Experience of the sort in question, which is well known, has demonstrated that excessive incidence of smallpox on populous areas in the vicinity of a hospital receiving a plurality of acute cases of the disease is no unusual occurrence, and it can hardly be doubted that the relationship between the operations of these hospitals and the excessive smallpox incidence in their neighbourhood is one of cause and effect. Further, it has been strongly indicated from careful study of various instances of "smallpox hospital influence," that explanation of extra incidence of smallpox around such hospital, by assumption of hospital mismanagement or of lack of precautions in regulating the necessary traffic and business of the establishment, does not suffice to account for the facts. The generally accepted and, so far as I am aware, the only completely satisfactory explanation of the peculiarities of smallpox incidence around hospitals receiving acute cases of the disease, is dissemination of infection by aerial convection ; an explanation introduced many years ago by Mr. W. H. Power, the Board's present medical officer, after detailed study of the behaviour of smallpox around Fulham and other London hospitals. He held that particulate matter capable of conveying infection, escaping into the air from the wards of a smallpox hospital, does on occasion and in suitable atmospheric conditions become wafted to considerable distances from such hospital.

"Hospital influence" in this sense has been traced in certain instances, where circumstances allowed the study to be made in respect of inhabited areas, as far as one mile from the hospital ; by some observers it has been thought to have been traceable, though to a much less degree, on inhabited areas situated even further than a mile from the hospital.

It has not, of course, been affirmed that, whenever acute cases are admitted to a smallpox hospital situated near a populous area, demonstration of aerial convection will certainly be forthcoming if only the facts be strictly studied.

There is ground indeed for belief that a smallpox hospital in a populous area does not, as a result of its actual operations, *always*, whether aerially or otherwise, distribute smallpox in conspicuous fashion in its neighbourhood ; and perhaps opinion has come to be entertained in some quarters that disadvantage such as accrued from Fulham and other smallpox hospitals may be regarded as the exception, not the rule. Similarly there has, when emergency has resulted in compulsory use as it were for smallpox of a hospital in a populous neighbourhood, arisen a tendency to minimise any mischief which may be alleged to be due to the hospital. A demonstration, therefore, of absence of spread of smallpox from hospital in the case of Liverpool, where three hospitals, two of them in the City, were receiving acute smallpox cases, and where in particular one of the hospitals (Park Hill) for a period of some 24 weeks at the height of the epidemic received acute smallpox patients in large numbers, would, if established, be not only particularly interesting to epidemiologists, but in its administrative aspects would be reassuring to smallpox hospital authorities."

My personal belief, if it be desired that I should state it, is that aerial convection probably operated in the case of each Liverpool hospital. The data placed at my disposal by Dr. Hope give little suggestion of support to the proposition that infection had occurred in the neighbourhood of any of these hospitals as a result of communications or traffic with the hospital. At most two or three instances of possible infection in this way have been traced. The assumptions required to explain the excess of incidence and the graduation of

incidence in each instance by a prolonged series of unsuspected communications between the hospital and its neighbourhood, undetected by Dr. Hope's staff, are, it seems to me, assumptions altogether without warrant.

In view of Dr. Hope's repeated references to Fazakerley hospital the following notes may be useful :—

The Fazakerley Smallpox Hospital is erected on a site outside the Liverpool City Boundary, and at the time of the Board's inquiry in 1898 as to the loan for this hospital site the surrounding population was given as:—

0–¼ mile =	4 houses,	9 persons,
¼–½ mile =	74 houses,	377 persons,
or 0–½ mile	78 houses,	386 persons,

and it thus complied with the requirements of the Local Government Board with regard to the population resident around such hospital.

The number of houses in 1903 had increased as follows :—

0–¼ mile =	9 houses,
¼–½ mile =	166 houses,
0–½ mile =	175 houses.

Taking an average of five persons per house, the population resident within the area of half-a-mile from the hospital would in 1903 be 875 persons, a number which exceeds the limit fixed by the Local Government Board. The Board requires the areas surrounding smallpox hospitals that are built under their sanction, to be sparsely populated with a view to minimise, as far as practicable, the amount of smallpox spread from these hospitals. Residence within half-a-mile of a hospital erected under such conditions, obviously in no sense guarantees immunity from smallpox infection to those persons liable to attack by this disease ; but the paucity of resident population allows of ready control of smallpox arising from proximity to the hospital. The Board is in no way responsible for any increase in the population resident around such smallpox hospitals subsequent to the Board's approval of the site.

My report clearly sets out that the special area within one mile of the Fazakerley Hospital contained 1,423 houses, and that of these no more than 33 houses were, in two years, invaded by smallpox. Numerically therefore the amount of smallpox disseminated in the mile area around it by Fazakerley Hospital was insignificant, and should have been correspondingly easy of control. Nevertheless relatively to their number these houses in the Fazakerley area suffered, as did the houses in the neighbourhood of the other two smallpox hospitals, a higher rate of invasion by smallpox than the houses in the City as a whole.

Considerable stress has been laid by Dr. Hope on the fact that although the hospital site at Fazakerley complied with the requirements of the Local Government Board at the time the land was purchased, yet nevertheless it has been shown by me in my report that the houses in the area around the hospital were not only not immune to invasion by smallpox, but suffered a greater rate of invasion than the houses in the City of Liverpool taken as a whole ; and from this it is wrongly inferred that I disapprove or condemn the Fazakerley Hospital site for the treatment of smallpox, and that I differ from my three colleagues, who have had officially to report to the Board on this hospital site. The answer to this is obvious. It is hardly necessary to point out that a house invasion rate of 3 per cent. in the case of a hospital like Fazakerley, which goes far to fulfil the Local Government Board requirements as to population, is a trifling matter administratively, by contrast with the bulk of smallpox arising from the same invasion rate in populous areas such as those round Priory Road or Park Hill.

RICHARD J. REECE.

6th July, 1905.