THE FREQUENCY OF SICK-ROOM INFECTION
IN
TYPHOID FEVER

It is generally accepted that the immediate cause of Enteric or Typhoid Fever is the ingestion of the Bacillus Typhi abdominalis of Eberth, and that the invasion of the body by the micro-organism may take place in various ways, as during the consumption of water, milk and other foods, the inhalation of effluvia from drains or miasmata from soil, and in other less frequent ways. On the other hand, the subject of the relative frequency with which cases of the disease can be definitely attributed to one source of infection or another has received comparatively little attention, with the result that little is known of it, so that a well-known medical officer of health fairly described the situation when he recently stated that "In probably over 80 per cent of the imported cases of typhoid fever, the origin of the infection cannot be ascertained with any certainty." (1)

I attribute this to the fact that many cases arise under conditions in which any one of several causes may be to blame and in which it is impossible to say that one or another is the cause of the disease. This is more frequently the case in urban than in rural districts, which latter offer greater
"The Frequency of Sick-room Infection in Typhoid Fever."

Additions and Corrections:

Page 1, line 19, for "imported" read "reported."
Page 2, line 2, insert "on the other hand after, "but."
Page 3, line 29, for "Soil Inspection" read "Soil Infection."
Page 11, line 29, for "house" read "houses."

Herbert Reck.
Chesterfield Rural District Council.

Medical Officer of Health,

HERBERT PECK, M.B., C.M., D.P.H.

St. Helen's, Chesterfield,

May 3rd 1893.

To Professor Fraser,

Dean of the Faculty of Medicine

Edinburgh University.

Dear Sir, M.D. The Rector,

I shall be obliged if you will make the additions and corrections mentioned on the opposite page to be made above sent in by me; or I shall be glad to make them if the paper is returned to me for a day.

Yours, Sir,

Yours faithfully,

HERBERT PECK.
facilities for accurate observation than do towns, but the number of cases occurring in rural districts is often too small for deductions from them to possess much value, even when the medical officer of health is alive to his opportunities.

It is in consequence of the neglect with which this subject has been treated, and of my belief that the danger of infection from one particular source has been much underrated, that I have taken as the subject of this paper what I have called (for want of a better name) "The Frequency of Sick-Room Infection in Typhoid Fever."

My observations and deductions therefrom are based upon my personal inquiries into the 206 cases of typhoid fever notified to me while Medical Officer of Health of the West Lancashire Rural District, during the six and a half years ending September 1898. The investigation of the cases necessitated the paying of more than 500 visits and much correspondence. The total probably includes some which were not cases of typhoid fever, but though I saw a few of the patients at the request of their medical attendants, I have no means of settling which were, and which were not, true cases, and have therefore included them all.

THE DISTRICT.
The West Lancashire Rural District has an area of 68,614 acres, or about 107 square miles, and had, at the time of the census of
1891, a population of 25,684 persons, composed chiefly of farmers, persons engaged in, or retired from, business in Liverpool or other neighbouring towns, a few hundred colliers and fishermen, and the families of these.

About 40 per cent of the houses in the district were supplied with water by public service at the commencement of the period dealt with, but the number thus supplied was gradually increased, and the percentage stood at 74 at the end of 1898. This affected my inquiry insomuch as it enabled me to exclude the water supply as a possible source of infection more frequently towards the end than at the beginning of the period.

Twenty houses were connected with the sewer of a neighbouring district, but the remainder were drained into cesspools, which the Sanitary Authority required to be impermeable.

The conservancy system was in vogue, but a large number of water-closets existed.

DEFINITIONS.

Before giving particulars concerning the class of cases with which this paper chiefly deals, I consider it advisable to define, as accurately as I can, the class of cases included under each heading of the following table.

**Soil Infection.** This includes the cases attributed to emanations from soil containing
typhoid bacilli. The experiments of Drs. Robertson(2)
and Sidney Martin (3) have established the long sus-
ppected fact that typhoid bacilli can exist for prolong-
ed periods in organically polluted soil, and even in-
crease in number.

The nine cases ascribed to this cause
occurred at intervals during a period of several years
in a hamlet which had been put in a sanitary condition
and provided with a public water-supply, after being
in an insanitary condition for many years, during
which, cases of typhoid fever frequently occurred. It
is possible that one or more of the patients acquired
the disease in another manner, but I ascribed them
as I have done after careful consideration.

Drain Effluvia. In the cases under this
heading, sewer gas was found to enter the houses in
which the patients lived, either from broken or de-
fective fittings.

Pollution of Watercourse. Five of the
patients whose cases are recorded under this heading
lived in two houses which had nothing in common, ex-
cept that they lived near a ditch or watercourse into
which the excreta of typhoid fever patients had been
thrown; owing to drought, very little but sewage from
an infected house higher up was passing down the
stream. Two other cases occurred simultaneously on
two dredgers working together on a canal which was
polluted with sewage at that point.

The other cases occurred in persons living
on the banks of ditches or streams into which filth
was surreptitiously placed, and which were sometimes very offensive.

**Manure.** Enormous quantities of manure are imported into the district, but the only classes of manure to which I attributed an outbreak of typhoid fever were "black manure" which consists of human excreta mixed with ashes and cinders, and "Oldham shoddy" which consists of human excreta mixed with refuse from cotton or woollen mills.

One case was that of a child who searched among manure for marbles, and the remainder those of men who had been working among it, or who had it stored near their houses.

**Water.** Many cases were probably due to this cause, but only one could be certainly attributed to it; this was the case of a woman who drank water polluted with the sewage of a neighbouring town, being the only one in the house to suffer at that time.

**Importation.** This term includes:

(a) Cases in which the patient had been away from home for more than fourteen days and returned ill;

(b) Cases in which the patient returned home after an absence of not less than one week, and sickened between five and fourteen days later;

(c) Several cases in which the patients worked in a neighbouring district on premises which inquiry, made at my request by the officials of the district, showed to be insanitary.

It is probable that several cases which should be included have been placed under "Several possible causes."
Sick-Room Infection. I have used this term to include cases due to the ingestion of specific bacilli directly derived from excreta and suspended in the air of the sickroom or infected part of the house, whether this took place in the act of eating or drinking, the swallowing of saliva, or in any similar way. The significance of the term will become more apparent upon a perusal of the cases ascribed to this cause.

Several Possible Causes. This term covers those which occurred under circumstances which rendered it impossible for me to ascribe the origin of the disease to any one of several of the above defined causes, or to any other cause such as milk infection, privy infection, and so forth, with a reasonable degree of certainty.

No Ascertainable Cause. This term explains itself. Included under it are doubtful cases which occurred on sanitary premises and undoubted cases which could not be ascribed to any known cause.

SUMMARY OF CASES.

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Number of Cases</th>
<th>Percentage of Whole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Infection</td>
<td>9</td>
<td>4.37</td>
</tr>
<tr>
<td>Drain Effluvia</td>
<td>21</td>
<td>10.2</td>
</tr>
<tr>
<td>Pollution of Watercourse</td>
<td>9</td>
<td>4.37</td>
</tr>
<tr>
<td>Manure</td>
<td>6</td>
<td>2.91</td>
</tr>
<tr>
<td>Water</td>
<td>1</td>
<td>.5</td>
</tr>
<tr>
<td>Importation</td>
<td>25</td>
<td>12.13</td>
</tr>
</tbody>
</table>

(6)
Sick-Room Infection .............. 28 cases equal to 13.5 of the whole;
Several Possible Causes .............. 69 cases equal to 33.5 of the whole;
No Ascertainable Cause .............. 38 cases equal to 18.44 of the whole;
Total .................................. 206 cases.

I. The patient, 35 years of age, frequently visited her mother and sister, living in another district, when they were suffering from the disease, and fell ill as they were recovering.

II. A woman, aged 29, came home from service in an early stage of the disease. Her sister, aged 11, slept in the same bedroom throughout the illness, and developed the disease in a typical form about a fortnight after her recovery.

III. A gentleman came to his country house while suffering from the disease, and one of the maidservants went down with it during his convalescence. She did not see her master during his illness, nor did she wash any infected clothing, and is believed to have contracted the disease through eating delicacies which had previously been in the sick-room.

IV. A priest, aged 30, attended patients suffering from the disease, and was taken ill with typhoid fever three weeks later.

V. A woman, aged 37, who had been frequently from home, developed the disease and died. Her child, aged 9, frequently sat with her mother and was taken ill the day she died. An elderly woman came from some cot-
tages half a mile distant, and nursed her through her illness, also washing her clothes, and developed the disease as her patient recovered. I know from personal observation that she sometimes took food in the sick-room. She returned home and was nursed by her daughter, aged 25, who, notwithstanding my remonstrances, slept in the sick-room and developed the disease nine days after she had disinfected and cleaned the house.

A child of 4 years was also taken ill, but the medical attendant did not regard her complaint as typhoid fever, though there was considerable gastro-intestinal disturbance.

VI. A woman, aged 30, was taken ill with typhoid fever and was nursed by a midwife. Her nurse returned to her home in a neighbouring township at the conclusion of her illness and developed the disease about a week later. I can only attribute her illness to her swallowing her saliva or eating in the sick-room, as I know she did on at least one occasion.

Several members of the family living in the house adjoining that of the nurse, frequently visited her and three of them were taken ill, but only one was notified as suffering from typhoid fever.

VII. A woman, 29 years, drank water from a brook polluted with the sewage of a neighbouring town, and was taken ill with typhoid fever between two and three weeks later. Her husband nursed her through her illness, and then developed it himself, whereupon he went to stay at the house of his father, a quarter of a mile distant.

His brother, 6 years of age, was taken ill
as he got better. The house was of only one story and the sick-room door was often left open, and so ventilated into the house.

VIII. A sailor, 42 years, came home from a long voyage and was reported the same night as suffering from typhoid fever, from which he died. His father slept in the sick-room and was taken ill with the disease nine days later. A woman, 32 years, nursed them, and was taken ill between four and five weeks after the return of the first patient; she was removed to a local hospital where she died. A boy, 7 years, slept in a room communicating with the sick-room of the first two patients, and developed the disease six weeks after the return of his uncle, the first patient, from sea. Fourteen days later, his other uncle, 27 years, who slept with him until the commencement of his illness, also went down with the complaint.

I had recently condemned the premises on which these cases occurred as unfit for human habitation, but they were carefully attended to throughout the series of cases, for which they were, in no way responsible. The water-supply was the same as that of a dozen other households which did not suffer from the disease. The excreta were disinfected with corrosive sublimate solution, 1 in 960, from the commencement of the outbreak, and I can only attribute the disease to the fouling of the bed-linen.

IX. A young man, aged 21, stripped off the wall-paper of a room in which there had been a case of typhoid fever, and began to be ill twelve days later. He
was reported, on the 16th day, to be suffering from typhoid fever.

X. A girl, 8 years, was allowed to sleep in the same room as a patient suffering from the disease, (which he probably contracted outside the district) the medical attendant saying that this was "quite safe". She was taken ill nineteen days after the first patient.

XI. A girl, 17 years, slept in a room leading from the sickroom of a typhoid fever patient, and began to be ill three weeks after the latter, the disease being well-marked.

XII. A woman, 26 years, worked on a canal-boat, and probably contracted the disease outside the district. Her brother, 29 years, attended to her on the boat, and began to be ill twenty-one days after she did.

XIII. A girl, 7 years, contracted the disease and died. Her sister, 18 years, came home about a week before the death and attended to her, being assisted in the task by her father. Both father and daughter contracted the disease and the latter died.

XIV. The first patient was one of two mentioned as having contracted the disease while working on canal-dredgers, and was brought home ill, but died twelve days later. His sister, 7 years, was frequently in the sick-room, and was taken ill with the disease twenty-two days after his return home.

XV. A girl, 7 years, was "feverish" and suffered from diarrhoea, but was not seen at that time by a medical man. A brother and two sisters slept in the
same bedroom and developed the disease simultaneously, about five weeks after the commencement of her illness. Their mother nursed them and developed the disease four weeks later.

Their next-door neighbour assisted them with the housework during the illness, and a child which she frequently brought into the sick-room developed the disease.

XVI. A person suffering from typhoid fever was frequently visited by his uncle aged 40, who spent many hours at his bed-side. The latter lived at a house about two miles away, and took to his bed twenty six days after his last exposure to infection.

CONCLUSIONS AND REMARKS

The sixteen groups of cases described above include 28 which may be accepted as cases of "sickroom infection", equal to 13.5 per cent of the cases investigated. Four other cases were probably also due to this cause, but I prefer to exclude them rather than weaken a good case by the employment of doubtful evidence. It is also probable that other cases are included under the headings "Several Possible Causes" and "No Ascertaining Cause".

My conclusions from the cases detailed are:—

(1) That sick-room infection is more common than is supposed, and that the danger of it does not receive the amount of attention it deserves;

(2) That sick-room infection is much commoner in the small and often crowded houses of the poor than in the larger houses of the well-to-do.
In support of these, I may say that though it appears remarkable upon first consideration that so little importance should be attached by the medical profession to this mode of infection, reasons for it are not hard to find. I think the chief of them are the difficulty of excluding other possible causes, and the comparatively small number of cases met with by individual practitioners.

Another is the fact that it is the practice in some general hospitals to treat typhoid fever patients in the same wards as patients suffering from other diseases. I do not consider the practice a wise one, for accidents may happen even in a hospital, though there is a great difference between the amount of risk incurred in a hospital, where the excreta are cremated or carefully disinfected, and the stock of linen is practically unlimited and articles are removed as soon as soiled, and in a cottage, where the importance of the disinfection of the excreta is not understood and the stock of linen is very limited, so that soiled linen is sometimes used for days and even weeks. In connection with this latter point, I may say that only two of the cases detailed, namely, Nos. III and XVI, occurred in houses with more than three bedrooms, and these did so under peculiar circumstances.

Under the conditions usually met with in small houses, opportunities are afforded for the drying of portions of the excreta of the patients and the diffusion through the air of the sickroom of the typhoid bacilli, and possibly, their spores. Those who have noticed the comparatively bulky motes illumined in a sunbeam will understand how this occurs.
Dr. Philip Boobbyer (4) found that 85.3 per cent of the cases which occurred at Nottingham during the ten years ending 1896 happened in houses of five rooms or under, and 14.7 per cent in larger houses. The sanitary condition of the larger houses may have been better than that of the smaller, and their occupants may have been more intelligent or docile than those of the cottages, but my own experience teaches me that this sidelight of Dr. Boobbyer's inquiry into "Endemic Typhoid Fever in Nottingham" tends to prove my contention that a larger number of cases of typhoid fever than is suspected is due to what has been called "aerial" and "direct" infection, but which I consider might be more appropriately called "Sickroom infection".