"An account of a Typhoid Epidemic"

being

A Thesis

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of the

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by

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a candidate for

the degree of Doctor of Medicine
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An account of a Typhoid Epidemic.

1. Introductory.

In the year 1882, an Epidemic of Typhoid Fever broke out in the city and adjoining districts of Bangor in North Wales. It was, in the magnitude of its extent, and in the proportion of population attacked, such an outbreak, as fortunately few communities have ever experienced.

Of this Epidemic, I here propose to give as full an account as lies within my power. I know that many details are wanted, many careful scientific notes and observations required, to make this what it is far from being, a complete and valuable account; but the circumstances of the period were such, that I had time for little, besides the hard work of my practice, and my duties as Assistant Medical Officer of Health.

At the same time, I may state that I have taken the greatest pains to verify all my facts, and to present a thoroughly reliable history, as far as it goes, of the Bangor Epidemic.
2. Description of the Town affected viz. Bangor, North Wales.

Bangor is a town and small sea-port in Carnarvonshire on the Menai Straits. The whole town may be said to consist of—Bangor proper.—Upper Bangor.—Hirael.—Garth.—and an adjacent hamlet called Glanadda. Its situation is at the end of a valley which runs in a north-easterly direction ending on the Straits. This valley, along which flows a small stream, the Adda, is somewhat wide at first, then, when within a mile of the Straits, becomes narrow for three quarters of a mile, after which, for the remaining distance, it broadens out, the hills on either side jutting a little to enclose the bay of Hirael. The districts above-named are situated as follows:—

Bangor Proper—lies in the hollow, where the valley is narrowest.
Glanadda— to the west.—Upper Bangor—on the hill to the north, while to the east Hirael on its small bay, at the north-end of which stands Garth, and at the south-end Port Penrhyn.

The Population in 1881 was about 9000, excluding Glanadda 8240. This population consisted in Bangor itself of the ordinary mixed town-class. In Glanadda and Hirael exclusively of the working class and in Upper Bangor and Garth of lodging house keepers, retired tradesmen, and a few of the working class.

The Principal Industries are slate-quarrying, slate works of various kinds, milling, bacon-curing and shipping.

Sanitary Administration. The whole district described was included in the Bangor Urban Sanitary District, excepting Glanadda, which was in the Bangor Rural Sanitary District. Both formed a part of the Carnarvon Combined Sanitary District, the Medical Officer of which was Mr. Hugh Rees.

The Sanitary Inspector for Bangor was an energetic officer, who was also surveyor & clerk to the Local Board & manager of the Bangor Water Works.
3. Description of the Sanitary condition of Bangor in 1882.

1. The drainage System -

a) Sewers - The town was drained by means of circular pipe sewers, the diameters varying from 18 inch in the main to 9 inch in the branch sewers. As may be seen from the accompanying traced plan, the main sewer runs along the centre of the valley, capturing the stream Adda from Glenadda to the Straits, where it discharged at that time in the mud between high and low water mark. This sewer receives the sewage of Glenadda and through its branches that of Upper Bangor, the town, the greater part of Garth, and all Ireland.

The sewer system at this period was ventilated but very imperfectly, there being but thirty ventilating points in the whole system.

b) House Drains -

I examined the houses of all classes, substantially and handsomely built villa residences, as well as those of the poorest class. In the former, I found the slopstone and soil pipes passing freely and directly into the drains. In many cases, I found sewage gas pouring from open untrapped pipe ends into houses through to extinguish a lucifer match. Where drains passed under the houses, as was not unfrequently the case, not only were they commonly laid in loose gravel, but in many instances, the junction between the sections was so faulty as to permit of sewage percolation. This state of things obtained in a very large proportion of the better class houses.

In the houses of the poor, in a densely populated part of Bangor, I discovered, according to my notes made at the
time, that in a whole block of small tenements with very
scarce back-yard accommodation, there was scarcely a single
house-drain in good condition. They consisted chiefly
of ordinary four or six-inch pipes, without either gully-trap
or grating to prevent choking and gas regurgitation. The
drain inlet consisted merely of a shallow pit of brick-
work, and a syphon bend in the pipe, while as often as not,
even that safeguard was absent. Strange as it may
appear, this was not an uncommon condition throughout
the town.

(2) Connection of House-drains with Branch Main Sewers

This was effected in all cases directly, without any cutting
off, either by means of syphon-bends in the pipes, ventilating grids,
or shafts.

It will be seen from these few facts, about the Drainage
System, how well prepared the soil was for the favourable
development of a Typhoid Epidemic.

Under this head, I now propose briefly to describe –

(3) The Water-closet arrangements –

In the better class houses, common Pan-closets furnished with
supply cisterns were generally in use. Some of these were
placed in the centre of the houses, while nearly all were
carried down to the basement to discharge into the
house-drain, without any serious attempt at ventilation.
Frequently, both the bath and lavatory pipes emptied their
contents directly into the soil-pipes or house-drains.
In houses of the cottage class, the closets were always
outside in the small confined back-yards, and consisted of
trapped Hopps fixed on the open drains. In one block
of buildings, and that not sanitarily the worst, I found
attached to these water-closets generally, a water-cistern but
rarely found a water supply. Naturally, in these cases, at frequent intervals, there would be choking of the pipes, with welling up of sewage matter. The only flushing these closets obtained was from the slops and dirty water which were thrown down.

Some rare exceptions to this description might exist, but certainly not sufficient to dilute appreciably the evil which so generally prevailed.

Privy closets with cesspits or middens attached, did exist, but in very few instances; indeed, not in more than five per cent. of the houses in the Urban District, and ten to fifteen per cent. of those in the Small Urban District.

Garbage, miscellaneous refuse, privy and midden contents were removed by the Local Authority or by the farmers of the neighbourhood. Still, this was done so irregularly as to permit accumulations, occurring sufficient to prove a serious nuisance and a source of danger to the community.

Slaughter-houses. — From the number of pigs alone slaughtered in a town like this, where bacon curing forms an important industry, it might be thought that special care would be taken to provide properly constructed and conducted abattoirs, yet this is not the case. Though I cannot speak from personal experience of all these places, yet I know them to have been and to be still, generally, in a highly unsatisfactory state. They are all situated amidst a dense population, and much of the blood and offal was at that time allowed to pass into the drains in defiance of existing byelaws.

Pigs — were to be found in all parts of the town and the Local Board took in insisting upon their removal.
Cows were kept by many people in places totally unfitted for the purpose, but it appeared to be hopeless to stir the Board into removing them.

The Water Supply was obtained above Bethesda, seven miles away, from the river Casg, below its junction with the Silafar. (See the accompanying Diagram Map showing the Water Supply, and mains showing also its distribution on the way from the intake through Bethesda, Llangedey to the Bangor Reservoirs.)

The river Casg, just above the intake comes rushing down like a cataract over rocks and boulders, and is thus dashed about into spray and foam, sufficient apparently to oxidise any quantity of organic matter, which it may contain, yet the intake was not beyond the reach of possible contamination, for on the right bank, are the Guernford and Llundwlandir houses, from which a small stream flows rapidly through the fields into the Casg, just above the intake pipe.

The water of the river passes through the intake pipe into the filter, which consists of a layer of sand, and one of gravel lying upon perforated tiles, which are separated from the brick floor beneath by a small intervening space, over this floor the filtered water flowed into the small adjoining reservoir. This water was, and always has been, good potable water.

Analysis has shown it to be of remarkable purity, showing the usual character of a good water which has flowed over a peaty bottom.

The district supplied with this water were, starting from above – Bethesda 141 houses Llangedey including Penrhyn Castle, Port Penrhyn, and the whole of Bangor and Glanadda.

Before leaving the Water supply, I may state that
when visiting the spot, the filter beds being away, under the said perforated tiles, I observed a layer on the brick floor of blue-black mud, which the water-manager and myself found smell badly. This was surely an excellent nidus for any specific fever poison passing that way.

The Milk Supply — In my capacity as Assistant Medical Officer of Health, I made a thorough investigation into the character of the milk houses in the Urban Sanitary District, and must state it was hopelessly bad; minutely into the details I cannot go, as it had probably no direct bearing upon the origin of the Epidemic, though it may have had upon its course and development.

There were twenty-eight milk houses then in the District examined, and though there were some which could not be declared absolutely unsuitable, there was not more than one or two which could be approved of. The majority were quite unfit for the purpose of affording the public a safe and wholesome Milk Supply.

I should like here to record my experience in one case— In the course of the Epidemic, I was called early by a man I never saw before, to see his boy whom he said was very ill. I went, and found the lad dead. He had been ill for a fortnight. His sister, aged 19, I saw in the next room in the Typhoid stage of the fever, and dying. She died within twelve hours.

The house was small, and ill ventilated; an open staircase led from the ground floor to the rooms above, where the children lay. A short way behind the stairs, a door opened into a room in the next house; beyond this door was another leading into a cramped back yard about 7 feet square. In the room of the next house referred, a cow was
kept, and in the yard, cow dung heaped. The drains were
untrapped and uncovered. The yard contained the usual
kind of closet already described. At the foot of the stairs,
down which feculent matter, rendered infected, had been carried,
milk was kept for sale in coarse and unclean earthenware
mugs. This was a milk-house.
I refused a Death Certificate in both these fatal cases.
I prohibited the sale of milk, and ordered the removal of the cow.
The Coroner held no inquest on the cases as he should have done.
A Local Board official told me English law did not sanction
my prohibition (it was carried out nevertheless), and the
keeping of the cow in that place was only stopped a few
months ago, nine years after the event.
Yes, it was the worst case, I admit, but the same laxity
prevailed throughout in dealing with the sanitation
of the milkhouses.
Possibly the English law is not stringent enough to
enable authorities to deal properly with milk-houses of
an improper character. The State of the Bangor Milk
Supply has now been pretty fully described.
Climate —
There is but little to say about the climate.
As I have already attempted to describe, the town itself
lies in the narrowest part of the valley, a very few feet
above the sea-level.
The climate in this hollow is decidedly relaxing, though
in Upper Bangor it is fairly bracing. The winds, which
from its position in relation to the hills, can touch the town
are the Easterly and Westerly winds. The North and South-
winds are not felt. During the winter and early
spring, the sun never warms the south side of High Street.
until noon.
I may remark finally, under this heading, that the Urban Sanitary District possessed no Infectious Disease Hospital, for the isolation of fever cases, and no public provision for the disinfection of clothing and furniture.
I have now stated briefly most of what there is to be said of the Sanitary condition of Bangor in 1882.

Previous sanitary history
Under the conditions described above, it will be interesting now to take a short survey of the sanitary history of Bangor during the five years preceding the Epidemic in 1882.
From this, it will be seen that Typhoid Fever was not Endemic, as might be expected, yet, with the exception of one year, the annual death rate was abnormally high, as might also be expected.

1877 - Death rate for the year was 21.22 per 1000.
This was above the average death rate of fifty, second-rate towns in England and Wales.

Analysis of the mortality according to cause –

<table>
<thead>
<tr>
<th>Cause</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarletina</td>
<td>4</td>
</tr>
<tr>
<td>Typhoid</td>
<td>1</td>
</tr>
<tr>
<td>Puerperal Maternal Fever</td>
<td>1</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>3</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>22</td>
</tr>
<tr>
<td>Acute Cholera</td>
<td>29</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>7</td>
</tr>
<tr>
<td>Injuries</td>
<td>6</td>
</tr>
<tr>
<td>Other Diseases</td>
<td>94</td>
</tr>
</tbody>
</table>

1878 - Death rate for the year was 23.95 per 1000.
An epidemic of Whooping-cough prevailed during a great part of the year. Scarletina in a mild form appeared, but caused no death. The district was less healthy than in the preceding year, but the rate of mortality in England, Wales
generally had increased.

**Analysis of the mortality according to cause** —

<table>
<thead>
<tr>
<th>Smallpox</th>
<th>Whooping cough</th>
<th>Pneumonia doubtful</th>
<th>Diarrhoea</th>
<th>Pneumonia</th>
<th>Bronchitis</th>
<th>Peritonitis</th>
<th>Heart Disease</th>
<th>Injuries</th>
<th>Other Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>26</td>
<td>21</td>
<td>9</td>
<td>6</td>
<td>112</td>
</tr>
</tbody>
</table>

1849 — Death-rate for the year was 21.46 per 1,000

Being again above the fifty second-rate towns in England and Wales. Scarletina was present during the year.

**Analysis of the mortality according to cause** —

<table>
<thead>
<tr>
<th>Scarletina</th>
<th>Beech</th>
<th>Whooping cough</th>
<th>Fever doubtful</th>
<th>Diarrhoea</th>
<th>Rheumatic Fever</th>
<th>Pneumonia</th>
<th>Death Chief Clerk</th>
<th>Heart Disease</th>
<th>Injuries</th>
<th>Other Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>44</td>
<td>11</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1880. — Death-rate for the year was 2.3 per 1,000

An epidemic of Measles of a severe type occurred. Scarletina was also present. This year the Local Board proposed to carry the main sewer outlet to below low water mark, but as I have already pointed out had not, up to 1882, carried out their intention.

**Analysis of mortality according to cause** —

<table>
<thead>
<tr>
<th>Measles</th>
<th>Scarletina</th>
<th>Fever Drench</th>
<th>Pneumonia</th>
<th>Afflicted</th>
<th>Heart Disease</th>
<th>Injuries</th>
<th>Other Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>24</td>
<td>19</td>
<td>10</td>
</tr>
</tbody>
</table>
1881 — Death-rate for the year was 17.2 per 1000. — A remarkable reduction, but it was a reduction which obtained over the whole of the United Kingdom. It was the lowest death-rate ever recorded, since the present system of registration was established. This marked decrease in the death-rate as affecting Bangor, appears like a calm before the storm. A mild form of scarlatina attacked a few children, but caused no deaths.

Analysis of mortality according to cause —

<table>
<thead>
<tr>
<th>Disease</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doubtful Fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>4</td>
<td>25</td>
<td>28</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Heart Disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary Fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The death-rate per thousand thousand, during these years has been based upon an approximate estimate of the population in each year. This estimate has been arrived at by dividing the difference between the population of 1871 and that of 1881, equally among the intervening years.

Health of Bangor immediately before the Outbreak. —

There is nothing of importance to note, with respect to the general health of the town, during the first four months of the year. But it were well to specify the dates when, and names of places where, Typhoid Fever occurred during that period. On the 21st January, a fatal case of "Gastric Fever" was certified as having taken place in Upper Bangor. Upon the 34th March, a case of Typhoid fever terminated
fatally at the Upper Bangor Infirmary in 4 days after its importation from an outside district. No other cases occurred until the 23rd May, when one was reported to be in Brick Street - Dean St. district. About the same date, the 23rd May, a case was going on, though not within official knowledge, up at Llwynrhandir, on the right bank of the Caereg (Vide Map II), above the Bangor water intake. About 6th of June, three cases occurred in Garth. Now as to the causes which gave rise to these cases.

1) The Gastric Fever in Upper Bangor, probably Typhoid, though the diagnosis appears to be uncertain - cause not known.

2) The Infirmary case was from the outside - the excreta were thoroughly disinfectected before being thrown into the drains. In following the Infirmary drain, which joins the main sewer in Glanrafon, we find that along its course no case was recorded.

3) The Caerwys case could have no possible relation to the last-named. - Its origin is not known.

4) The Brick Street case, on 23rd May is unaccounted for. It had assuredly no connection with previously known cases. For if Map I, showing Sewer System be consulted, the sewer connection between the cases is too remote to allow of infection. Obviously, the poison contained in Typhoid stools may take effect at any distance from the sick, but the bacilli (or fever poison) appear to lose vitality at a short distance outside their native fluid, however contaminated the surrounding air may be. This must be the fact, otherwise Typhoid would be propagated as easily as Cholera, and we know the propagation of Typhoid from man to man is not easy. Even in the houses of the poor, a case occurs, and has been going on long before the doctor...
is called in - infective matter and disinfecting passing into
drain or privy, and how rarely is it found that more than
one case takes place at a time in a house.
Time after time do we find single cases occur in households
rarely whole families attacked, except when the disease
can be traced to a common source. Therefore it can be
said fairly, that for a case in Caellepa (Vide Map I), to
infect one in Brick Street, and none in the other
intervening parts is well-nigh impossible.
The bacilli would have to travel down until the stools,
first to the main sewer, then along that sewer some
200 yards, after that, travel up the Dean Street branch
sewer, not in the liquid but in the air of the sewer,
as far as Brick Street, at the top of Dean Street, a distance
of 300 yards. And all this without infecting any
person in route, either on the right hand or the left.
The theory of air, or sewage gas propagation for long
ranges would never recover from the strain, were it made
to account for the spread of Typhoid in this particular case.
5) The origin of the diarrhoea handicap case is unknown to me.
6) The three cases which occurred at Garth were said by the
medical attendant to have been caused by privy refuse
deposited on the fore-shore, near where three cases (children)
had been playing. There is no reason to doubt the
accuracy of this opinion. As they were known to be
Typhoid, their excreta were safely disinfected; and
situated as they were, at the end of the sewage system,
the whole passed out to the sea without infecting
the town sewers.
Beginning of the Epidemic —
During the week ending the 20th of June, nine cases of Typhoid Fever broke out almost simultaneously in different parts of the town. viz., two on the 16th, three on the 18th, one on the 19th, and three upon the 20th.

These cases, as well as those of the succeeding months are shown in Map I., by a distinctive mark for each month.

They occurred in Caellepa High Street. — Gaithapart not connected with the town sewer, — Port Penhip, also unconnected — Upper Bangor, Hill and, and Moirant Street, all of them district remote from each other.

Notification, not being compulsory, neither the Medical Officer of Health nor the Sanitary Inspector was aware of these cases; nor did one medical man attending perhaps a case or two, know that all his colleagues were similarly employed.

Thus the Epidemic began, and became fully developed, before the Sanitary Officials knew of its existence.

During the week ending June 27th, twenty-five fresh cases occurred, and by the end of the following week another twenty-five. It was a day or two after this, that the Medical Officer of Health first knew of this formidable spread of disease. He then held from possession of the town.

Discovery of the Cause — I shall now endeavour to show the cause of this serious and extensive outbreak.

A most careful inquiry was made into the Milk Supply, but bad as the state of the milkhouses has been shown to be, yet nearly every patient had his milk from a different source, some good, some bad. — The cause was apparently not there. I have gone pretty fully into the probability of infection from sewer, and I think have shown the improbabilities to be so great as to justify one in dismissing the question.
Further, some of the earlier cases were not on our sewer system at all; though at the same time, it must be admitted that there can be no doubt the spread of disease was distinctly favoured by the sanitary condition both of the drainage and milk supply.

While the fever was raging, with gallons of infected matter pouring down the sewers, out of twenty-two men, ages ranging from 20 to 50 years, constantly at work upon the outlet and sewers, not one took fever, while of the ten police men on duty during that time, ages the same as the others, five were attacked, and one died.

The only connection between some of the cases affected, living as they did some of them miles apart was the Water Supply, which as will be seen from the diagram, Map II, went to Bethesda, Llandegai, and Port Penrhyn & Bangor. When we find these, the fever in Bangor distributed in the manner described, and further, that fever existed along the course of the Water Supply, we suspect the evil lies there. And we become sure of it, when it is ascertained that just above the intake at Llwynrhandir, (vide Map III), cases of typical Typhoid have occurred, infection from which found its way along the streamlet, already noted, into the Cases, and so into the filter beds and U reservoir.

It was the 13th June, when Mr. Rees, the Medical Officer of Health, first knew of these cases. But even then, he did not know of the above small stream.

However, he ordered the people to bury all fermentable matter. It is difficult to get people to obey orders of this kind; they seem not to realise their importance.

It is to be feared they did not obey. It is almost certain
that infective matter was allowed to pass down the stream
to the Bangor intake. In any case, as there had been
fever at Clywnothawd and since the 23rd of May, enough had
passed down to infect the filter beds, there in the foul mud
bottom, the bacilli (or fever poison) would abundantly
multiply, and so contaminate the Bangor, part of
Bethesda and Llandegai Water Supply.

This, I have no doubt was the cause of the Bangor Epidemic
Report of the Local Board. Upon the 8th July they were
informed by the Medical Officer of Health of the extent
of the Epidemic, and of its cause.

The action of the Authority upon this was to send off
specimens of the water to be analysed, and on
receiving thereon from Dr. Mair, a favourable report
to reject the opinion of Dr. Rees. The comment of the
Chairman of the Board, upon the Medical Officer's statement
was, that it was unfortunate he had suggested the cause
was in the water, as it created uneasiness and did
injury to the town. The Board said the cause was
in the drains, in the air, anywhere, not in the water.
This opinion would not have mattered much, had it
not clogged their action in carrying out the instructions
of their adviser. Those instructions were to cut an
intercepting trench between stream and river, and
to cleanse the filtering material. This was on the
8th of July. The trench was commenced on the 17th of
August, completed on 5th of September.

While inactive in this direction, the Board was
active enough in carrying out other measures
recommended, such as flushing, disinfecting with
Chlorine (obtained by acting upon hypochlorite of Potash.
with crude Hydrochloric Acid) the sewers and house drains. Infected houses were supplied with disinfectants for steeping cloths, and pouring down W.C.'s. The amount spent upon disinfectants alone up to the 21st of August, was £100. The Epidemic lasted over two months longer, during which probably an equal amount was spent, making a total of £200 on disinfectants alone in this small town.

Advance of the Epidemic — As I now propose to continue this narrative without break to the end, it will be well for me at this point, to put in the table I have of the cases, in the order of time and place of occurrence, so that the advance of the Epidemic may be seen at a glance. I have endeavoured also roughly to give an idea of the distribution of the disease in Map I, where, as I have said, the cases occurring have a distinctive mark for each month. In the table, I have failed to show the order in time and place, during the last week in July, and the first three weeks in August. This table was compiled in the following manner: The Local Government Board Inspector drew up a table of cases to the end of the 25th of July, which were supplied him by the Local medical men, and from the 25th to August, the same gentlemen supplied daily reports, which I now have in my possession.

Of these two periods, I have been enabled thus to draw up an analysed weekly summary of the cases, whereas for the intervening period, I have failed to obtain anything more than the total number of patients. As I have said, the measures taken by the Local Authority to combat the disease were most energetic in every way.
<table>
<thead>
<tr>
<th>Date</th>
<th>Rural S.D.</th>
<th>Urban Sanitary District</th>
<th>P.S.D.</th>
<th>Weekly Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 23</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>.. 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.. 13</td>
<td>none</td>
<td></td>
<td></td>
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(to face page 17)
except in the particular of attending to the Water Supply. The Board, together with benevolent private persons established soup kitchens, and made an arrangement with the Poor Law Authority, whereby the Workhouse Infectious Hospital, accommodating 74 patients, was opened to the poorer portion of the community, while the Infirmary in Upper Bangor took in 11 patients.

Strange as it may appear, however, it was not until the 12th of August that the Local Board realised fully that the Epidemic was one of extraordinary magnitude, and not to be controlled in the way they were proceeding. They however realised, that something must be done for those sufferers who had not the means to supply themselves with the nursing and nourishment required in such cases, that means must be taken, to take over the full management of the cases, to make sure that their treatment was adequate, and that in each case, sanitary precautions were taken.

The Board began, by employing the superintendent of the Nursing Institute to attend to the nursing of the poorer patient. On the 19th of August, partly at my suggestion, a very large unoccupied house was taken, thoroughly cleaned aired, and fitted up to accommodate 94 patients. This was in the Kircal district. There was great opposition to the arrangement from the Bishop of the Diocese and others on the ground that it was situated in the midst of a dense population - a purely fanciful objection, because while the excreta and other discharges were thoroughly disinfected, there was no need for alarm. What we required was to know, as I have pointed out, that every case was well treated,
and that sanitation was properly carried out. These requirements were supplied by this temporary Hospital. But gradually, the Workhouse Infections Hospital, the Bangor Infirmary, and the quarantined area, all became full. It then became necessary to find further accommodation; and towards the end of August, after some postponement of the question, Tent Hospitals were erected for 20 patients, one for males, another for females, and a third in reserve. The Medical officer and myself were more favourable to temporary wooden structures for that uncertain autumn weather. Mr. Rees stated that were a storm of wind to come upon them, he feared they would not stand the strain. In addition to the above, provision was made for the convalescents, who were not fit to work, and had not the means after so long an illness, to obtain at home the requisite nourishing food. So, a convalescent home was established in Upper Bangor, in the face again of much unreasonable opposition on the part of the inhabitants of the place.

The hospital accommodation, therefore, by the end of August was fully adequate to meet existing needs; though the weekly average was still about 50. Some difficulty was experienced at first in getting patients to the hospital, but this soon passed away.

I shall now consider briefly the Hospitals, which were brought into use during this Epidemic.

1. The Workhouse Infections Hospital

The accommodation here was under the circumstances just passable, but by no means commendable, the space for each patient being about 700 c. ft.

Objections to this arrangement:
a) The idea to an honest workman of going to any place of this sort is by no means a palatable one, and such feelings are to be respected and encouraged.

b) A town should have provision for infectious cases, independent at any rate from the Poor Law Authority.

c) It was distinctly illegal for the Board of Guardians to allow of such an arrangement, as was subsequently pointed out to them by the Local Government Board.

2. The Infirmary at Upper Bangor — was in many respects all that could be desired, but the accommodation was small—only 11—and the serious interference with the ordinary routine work of the Institution made it highly undesirable that a small general hospital of this kind should be asked to take in such cases.

3. The temporary Hircal Hospital — did well enough, and it was generally the opinion that in emergencies such as this, unoccupied houses taken temporarily as required, are on the whole convenient enough.

4. Tent Hospitals —

The objections to their use:

a) Too hot during a warm sunny day, and always too cold at night. Even where the walls and roof were double, it was found impossible to maintain an equable night and day temperature. However, at great expense, a heating apparatus was put in.

b) The difficulty of dealing with the sewage matter.

In our case — The tents, by the timely generosity of the Bishop were allowed to be set up in his park, and the fecal, and other refuse matter was removed in close iron tanks, taken to the sea, and emptied at lowwater mark during ebbing tide — a clumsy arrangement — but owing
to the distance from the sewer, it was the only one that suggested itself.
e) The instability of tents: however firmly they may be fixed. Those we had, were of large size, pavilions in fact. They were made secure by sailors, and men accustomed to such work; nevertheless, upon the 1st of October, a Sunday, a storm came, and actually blew them down upon the ten to fifteen sick lying within.

It was a serious matter to the female patients had all to be moved, huddled together in the one tent which stood the strain - a very small one. That night every temperature rose at least 10° or 15° higher than the previous night. We succeeded in calming the patients and the nurse, the latter a most difficult operation, and a wooden barricade was erected to break the force of the wind; the ropes and supports were made as secure as possible, and so we managed to avoid removal. However, in the meantime the schools close by were prepared, ready to receive the sufferers if removal became urgently necessary. I do not consider that tent-hospitals are to be recommended for circumstances such as ours.

1. You cannot always select a sufficiently sheltered spot your surface expose to wind-pressure is so large that the strain is more than ordinary fixing can be calculated to resist.

2. The sewage difficulty

3. The impossibility of keeping up night temperature without going to great expense.

The only rational scheme to meet these outbreaks is to have
An Isolation Hospital, planned on the Pavilion system, with a detached administrative block which should be large enough to supply the needs of at least four Pavilions.

At first, one Pavilion might suffice, it should be so arranged in the ground, as to allow other Pavilions, permanent or temporary, to be added as required. For this purpose, two acres of land would be required for a place, the size of Bangor. A public disinfecting chamber should be attached.

Throughout July and August the Epidemic advanced steadily, until it reached its culminating point in the middle of September. Up to that time, when the reports showed a sick list of 50 per week, 475 persons had been attacked, scarcely a household in the town had been unvisited. The streets were well lined with nursing stations, and in meeting together, the talk of all men was of the sickness, and hopes there were of its early abatement. The streets were seen filling about everywhere, as they went on and off their duty. While here and there would be seen a convalescent wrapped up, taking the air.

At all hours, the Ambulance Van might be heard rumbling with patients, to one or other of the hospitals.

This was the state of Bangor in the summer of 1882. Its business gone, and its markets ruined. And so on through the hot days of August and September. The figures showing the number of sick per week are given in the table; it is therefore needless for me to repeat the same here.

The week ending 26th of September saw the termination of the advance-period. It ceased thereafter stalking from house to house, with such rapid strides, and the worst was now over.
Decline and End of the Epidemic —

Having at last completed the intercepting trench, between polluting stream and river at the intake, and having removed the filtering material, on the 5th of September, all possible danger of infection from the water ceased.

But of course it took many days for the pipes to get clean of infective matter. However, in the last days of September, namely, the week ending October 3rd, the Epidemic showed signs of abating. The number of patients for the week dropped from 49 previous week, to 241, and the next week to 11, and until after the 8th of November, we had no more cases to report. This proved to be the beginning of the end.

If further evidence were needed, it appears to me, that this abatement, after cutting the trench and doing away with the filters is enough to prove the Water Supply at fault. It may be argued that the subsidence took place with the advent of colder weather. But it has been shown (Murchison's Contagious Fever - Page 416) that the largest number of cases during the year, occur in September, October, August and November, in the order named; whereas in Bangor the order was August, September, July, October, June, November; neither can the subsidence be shown to be due to the flushing, and disinfecting, for that was done by the Local Board most zealously from July onward, with practically no effect upon the prevalence of disease.

The cost to the town of the visitation is difficult to estimate, but in cash it was a sum not far short of £4000 including a relief fund of £500. The loss to the town in business has been variously estimated, but the probable estimate
is something like £10,000. The weekly market, for instance, was quite ruined, indeed now after the lapse of nine years, it is only beginning to be what it was before 1882.

The cost to the workingmen in loss of wages and expenses amounts to about £1,500, making altogether an estimated total loss of £15,000.

The Character of the Epidemic —

This epidemic was remarkable, more on account of the magnitude of its extent, than on account of the severity of its type. Bungo was, as far as my knowledge and reading in the course of a typhoid epidemic go, the only town which has ever been saturated so completely in every district and section with disease. As I have endeavoured to show on the marked map, an occasional house escaped, but not a single street. The mortality during this epidemic was low, only 12.8%.

In the whole district affected, there were 690 persons attacked, of these 89 died, given the above percentage, which is very much below the general average recorded by Ballingallon, which is 18.52 per cent. I shall here attempt to account for this.

1. As recent residence in a locality increases so long residence must diminish the mortality in typhoid. The population of Bungo was not of a shifting character. The patients attacked were almost without exception permanent residents; in my own list all were of that class, and my colleagues make almost the same report.

There were a few visitors and new residents, but not enough to affect the rate of mortality.

2. The infection came through the water which was otherwise quite pure. Cases which concluded "took" the disease from excreta of sewage or other sewage or from contracted described cases, for example, and those who lived in houses with small yards.
having bad drains, were far more severely attacked and did much worse than those who were infected by the water. Owing to the terrible strain during those weeks, upon one there was no time to carry on that careful investigation in this and many other directions, which one would have wished. Therefore this is pure theory.

3. Another suggestion to account for the small mortality is given for what it is worth. Murchison states (Murchison’s continued Fevers—Page 533) that during 14 years, the mortality in Typhoid among the Irish in London Fever Hospital was only 9.36. He offers no explanation. Therefore I have thought there may be some similarity in the two Celtic races in this respect.

4. Station in life—Although all classes were attacked, yet, by far the greater number was among the poor population. I account for this thus:—

The more intelligent, upon being informed, the cause, took precautions and boiled the water. The poor people not, so they suffered most. Typhoid appears to be most fatal among the richer class, in private practice (vide Murchison’s Continet Fevers—Page 533).

I regret that I cannot with any certainty, give the ages or sex of the patients.

The symptoms observed in the course of the epidemic were of the usual character, and present nothing of very special interest. I shall take the symptoms in the order laid down by Murchison, leaving out those on which I have no remark to offer:—

1. Rose Spots—were observed as a rule upon the 9th to 44th day, but I failed entirely to discover any in some cases, where the other symptoms, such as headache, fur red
tipped tongue, and diarrhoea with characteristic stools, were
well-marked.
2. Desquamation during defervescence
Observed in many cases.
3. The temperature ranged from 105° to 106° - evening
temperature in one fatal case touched 106° - shortly before
death. In one case I had the temperature taken with
the greatest care each time, showed a morning rise, for which
I could not account. After two doses, 10 grains each of
quinine, given at night, the temperature went up next
morning, higher than usual. The case recovered. The
sudden fall with

4. Haemorrhage was noticeable.
5. The skin was characteristically dry and rough.
The skin of palm, and of abdomen, had a peculiar
hard feeling.
6. I must state that in almost every case I observed,
an odour which in my opinion was quite unmistakable
perceived especially on first raising the clothes to examine
patient. I cannot accurately describe it, a
peculiar musty odour.
7. Tongue - exactly as described by Hirschfield - five of
varying thickness, with tip and margin red. In one
very severe case only, after most profuse Haemorrhage,
while in the Typhoid stage did I note the fissures -
across the tongue. One was so deep as to threaten to cut
the organ in two.
8. The characteristic diarrhoea, after lasting two or three days
frequently disappeared to be replaced after by Constipation.
This occurred frequently more so than I had ever read or heard of. The other symptoms persistently remaining.

9. The stools were characteristic. Often when the looseness abated the ochre colour remained.

10. Sympathy occurred only in four cases, and there ended fatally in my practice.

11. Hemorrhage.

12. Delirium — One noteworthy case, where delirium was violent and noisy; it terminated in a semi-hysterical enervated condition, which lasted after convalescence from the fever, three weeks, and finally recovered without impairment of the faculties.

13. Deafness and epistaxis were observed commonly.

14. Paralysis — One case only suffered from Hemiplegia and loss of speech.

15. Pneumonia — In my practice, this complication occurred not so much as Hypostatic, but as Acute Pneumonia; a group of cases occurred in the Dean Street District, where back yard was confined.

Case I — Female, age 7, complaining of dry cough, shortness of breath, prostration, pulse 130, temperature 104°. Respiration 48. Pulmonary lower part left lobe, minute expectoration, no febrile state in the neighbourhood.

Treatment — Poultices, Beonits, six minute doses every hour. Diet — milk and beef tea. In 48 hours all the symptoms had disappeared. I kept the case under observation for 21 days, until quite well — no relapse.

Case II — Female, age 46, mother of preceding. Symptoms similar, Herpes on lips. I put her on the same treatment for 24 hours. There was distinct improvement, but
after 48 hours, diarrhea with characteristic stools appeared. Remorse in small doses was then given, finally the case ran the usual course of mild typhoid until complete recovery.

CASE III—In the same house, male, age 48, husband to last-named, a typical case of moderate typhoid which made a good recovery. This last case proves that cases I and II were purely cases of Primary typhoid pneumonia.

CASE IV—Female, age 24, servant-girl, ill for 24 hours, previous to my seeing her, severe pneumonia, with rusty becoming plum-coloured sputum, accompanied by characteristic typhoid diarrhoea. This patient died in 4 days of pneumonia.

I am not aware that a post-mortem examination was obtained in a single case, so that I can state nothing about the morbid anatomy. Probably, it would not have presented any particularly new or instructive feature.

Treatment—consisted chiefly in proper diet and abstinence from interference of a meddlesome nature. The use of antipyretics did not appear to influence in any way the course of the disease. Where no danger is to be apprehended from the temperature itself, it appears best for the patient to leave it alone. When the cardiac first sound softened, stimulants were found useful; and when all hope appeared gone, stimulants given boldly often saved lives.
General Observations —

My opinion is, that this Epidemic was twice as extensive as it need have been. Had the Urban Sanitary Authority promptly carried out the instructions of their Medical Officer of Health in the matter of cutting off the Elwynrhaudir contamination, and of removing the polluted filter beds, the August period of the Epidemic would never have been reached.

The existence of the fever in Bangor, was unknown prior to the 4th of July, because notification of infectious diseases was not compulsory, and this defect, considerably hampered at every step the work of the Sanitary Officials.

One word more, as to the regulation and control of the Milk Supply. Until milk-houses are, after a careful examination of their fitness, by competent officials, duly registered, and even licensed, and subsequently subjected to a regular and rigorous inspection both of the dairies and cows, no community can feel secure of having a reliably wholesome milk supply.

In conclusion, I should in fairness remark, that though much remains to be done, to perfect Bangor Sanitation, most of the defects above noted have been remedied. The drains & water-closets are cleanly and efficiently ventilated and trapped; refuse-matter is removed regularly & nuisances arising therefrom are rare: the water intake has been carried to the heart of the mountains; beyond the possibility of sewage pollution; and the town has adopted the Compulsory Notification of Diseases Act, which has already proved of great service in stamping out Infections Disease.
Finally, poxtie justice has been meeked out to the Local Board. It has been abolished. It is defunct and a Town Council arranged in its stead.

The details of sanitation and other town matters are apportioned now to various committees, where they are attended to carefully and intelligently.

So that, at the present time, I consider nothing is more unlikely to occur that a repetition of the Bangor Typhoid Epidemic of 1862.