

Dr. Carnwath's report to the Local Government Board upon an outbreak of enteric fever at Oakenshaw in the Urban District of Willington.

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REPORTS

TO THE

LOCAL GOVERNMENT BOARD

ON

PUBLIC HEALTH AND MEDICAL SUBJECTS.

(NEW SERIES, No. 59.)

Dr. Carnwath's Report to the Local Government Board upon an outbreak of Enteric Fever at Oakenshaw, in the Urban District of Willington.



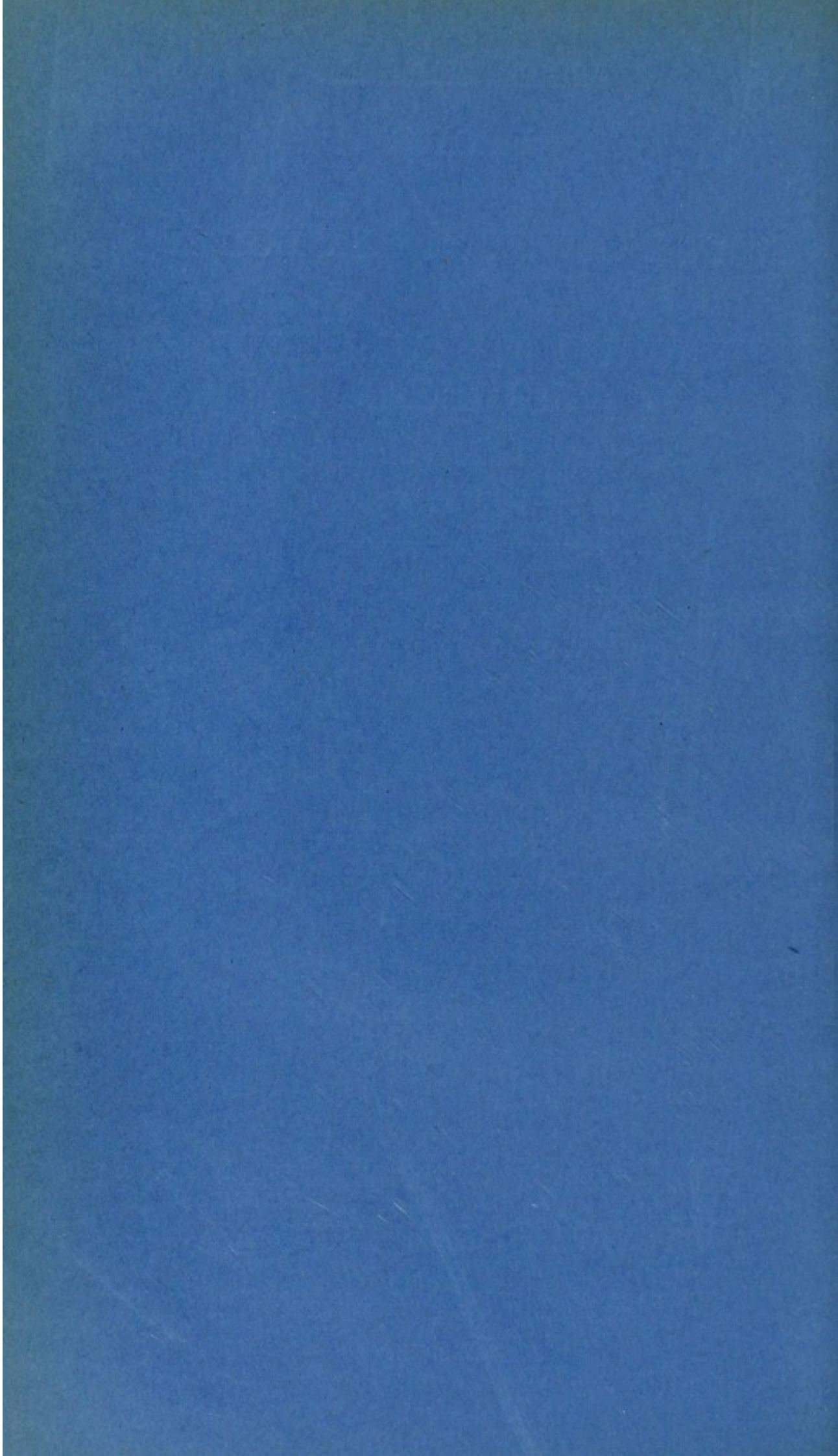
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Dr. Carnwath's Report to the Local Government Board upon an outbreak of Enteric Fever at Oakenshaw, in the Urban District of Willington.

ARTHUR NEWSHOLME,

Medical Officer,

9th January, 1912.

On May 19th, 1910, the medical officer of health of the Willington Urban District reported to the Board that an outbreak of enteric fever had occurred at the Oakenshaw Colliery in that district.

Inquiries instituted by the district council having failed to reveal the origin of the infection, the Board decided that an investigation of the circumstances should be made by one of their medical inspectors. This duty was allotted to me. I visited the district in July, 1910, and on several subsequent occasions.

SANITARY CIRCUMSTANCES AND ADMINISTRATION OF THE DISTRICT WITH SPECIAL REFERENCE TO OAKENSHAW.

Willington is an urban district of 3,793 acres, lying on the north side of the river Wear, about seven miles south-west of the city of Durham. It is roughly lozenge-shaped with its long axis east and west. From the river, which forms the south-eastern boundary, the ground rises gradually towards the north-west. Its configuration is irregular—the altitude varying from 200 to 700 feet above sea level.

The population, which was 7,887 at the 1901 census, was returned at 8,734 in 1911. The principal occupations are coal mining and coke making. There is also some brickmaking, and in the northward part of the district are a few dairy farms.

The chief centres of population are Willington (including the Brancepeth Colliery Rows), Oakenshaw and Page Bank.

Oakenshaw, where the outbreak of enteric fever occurred, is an isolated village situated on the high land about one and a half miles to the north of Willington. It is a typical mining community with a population of some 1,280 persons. The "rows" or streets of which it is composed are ranged mostly north and south as follows:—

1. New Row (64 houses) continued southward in Institute Street (16 houses) and Old Row (38 houses).
2. First Single Row (37 houses), Second Single Row (37 houses), and School Row (34 houses), all parallel to and west of Old Row.
3. Cross Row (22 houses) to the north of and at right angles to New Row.
4. "Colliery Farm"—two small detached tenements near Cross Row.

No. 59.

The cottages are four-roomed with the exception of those in First and Second Single Rows which contain each only two rooms.

The following description of the sanitary circumstances of Oakenshaw may be taken as generally applicable to the whole urban district.

Drainage and Sewerage.—Drains are represented for the most part by open half-pipe channels which run close by the doors of the houses and receive the kitchen slop waters. The very considerable streams thus formed are a fruitful source of unsavoury and, it is to be feared, somewhat risky, amusement to the children.

The main sewer is of glazed stoneware with puddle joints. By a devious and but imperfectly known route it reaches ultimately the Brancepeth Colliery ponds and thence the diluted sewage finds its way along the course of the "Old House Beck" to the River Wear.

The sewage of Page Bank and Oakenshaw is untreated ; that from Willington undergoes some degree of purification by means of septic tanks, bacteria beds, and sand percolation before being allowed to enter the river.

Refuse and excrement disposal.—There are no waterclosets in Oakenshaw. The common form of closet accommodation is the privy midden, or a modification known as the ashcloset in which the midden part of the system is done away with and the space under the seat remains the sole receptacle for ashes and excrement. The ashcloset is emptied from the rear or from the side through an opening closed by an iron swing door. If properly constructed it is an improvement on the old privy midden, but it still falls far short of what, from the sanitary point of view, can be regarded as satisfactory.

The privy middens are huge structures ranged in rows in the open street, a large part of which they occupy. To a stranger they form the prominent feature of the village. The middens are large and mostly uncovered. Few of them are watertight, and the free soakage of the filth into the ground and through the containing walls was a subject on which complaints were frequent.

The scavenging, which is carried out by contract, takes place at all hours of the day. I was informed that it was no unusual spectacle to see a family at dinner while the midden was being emptied a few feet away from the doorstep.

The Oakenshaw refuse and excrementitious matters are tipped in a field near New Row some 50 or 60 yards distant from the houses.

The back streets are unmade and the statement of the medical officer of health that they are "perfect quagmires after a little rain" may readily be believed. It is difficult, if not impossible, to scavenge such streets efficiently.

Water supply.—Like the rest of the urban district Oakenshaw is supplied with a good upland surface water from the mains of the Weardale and Consett Water Company. Each house has a separate supply tap.

There are only a few outlying farms in the district which are dependent on springs.

Housing.—In 1908 the housing conditions of Willington Urban District were reported on by Dr. Smedley, the assistant county medical officer of health. Since then some improvement has been made, but in the main Dr. Smedley's strictures still apply. Attention may be drawn specially to the large number of old, badly-designed and badly-constructed two-roomed cottages in which the second room or bedroom is represented by a low attic insufficiently lighted and imperfectly ventilated. There are no means of perflation in many of these upper rooms, and consequently the air is renewed chiefly from the heated and impure atmosphere of the room below. At the time of my inquiry First Single Row, Oakenshaw, was a collection of such dwellings, but since then these have, I believe, been raised and otherwise improved. There still remain, however, many and worse examples in other parts of the district.

The kitchen annexes are often of the most primitive description, and there is general absence of baths.

Few of the houses have backyards, so that there is not infrequently difficulty in telling which is the back of a house and which is the front. By common consent, however, that is generally known as the back street in which the privy middens are placed.

The open and exposed position of these privies was complained of, especially by the women.

Overcrowding.—In 1901 30·9 per cent. of the population of Willington Urban District were living in "overcrowded" tenements, *i.e.*, tenements with more than two persons to each room. This is slightly in excess of the average for the whole county (28·48 per cent.) which occupies the unenviable position of being one of the two counties with much the highest proportion of overcrowded tenements in England and Wales.

Prevention of Infectious Disease.—Every house invaded by notifiable infectious disease is visited by the medical officer of health or the inspector of nuisances, and advice is tendered verbally as to the precautions to be observed. Questions are asked with reference to the source of infection, but unfortunately the inquiries are not systematic and no record is kept of the facts elicited. On termination of the illness or after removal of the patient to hospital the sick room is fumigated by burning some sulphur. Bedding, with such of the clothing as cannot be boiled or otherwise disinfected at home, is taken to the steam disinfector at the isolation hospital. Convenient hospital accommodation is provided by the Auckland Shildon and Willington Joint Hospital Board at Helmington Row.

HISTORY OF THE PRESENT OUTBREAK.

Although enteric fever is endemic in Willington, Oakenshaw was, for many years previous to 1909, relatively free from the disease.

The history of Oakenshaw, Page Bank, and Willington in this respect year by year since 1891 is shown in the following table :—

TABLE I.

Showing the number of cases of Enteric Fever year by year since 1891 in each of the three divisions of the Willington Urban District.

—	Notified cases of Enteric Fever, Oakenshaw.	Notified cases of Enteric Fever, Page Bank.	Notified cases of Enteric Fever, Willington.
1891	1	—	3
1892	1	—	6
1893	9	—	42
1894	1	—	9
1895	—	—	8
1896	—	—	9
1897	—	—	15
1898	2	2	28
1899	3	—	13
1900	1	1	11
1901	2	—	21
1902	2	—	9
1903	—	—	3
1904	—	—	5
1905	2	1	6
1906	—	3	3
1907	—	—	2
1908	—	2	8
1909	6	1	6
1910 (up to July 31st)	26	—	2

In 1909, however, sporadic cases of fever began to occur in Oakenshaw with unusual frequency and this continued on into 1910, finally culminating in a severe outbreak in April and May of the latter year. As is seen from the foregoing table this was unaccompanied by any corresponding increase of the number of cases in other parts of the urban district.

During the course of a preliminary investigation it soon became evident that the extent of the outbreak was much greater than had at first been suspected in consequence of many cases having been overlooked. With a view to the discovery, as far as possible, of such unrecognized cases a house-to-house inquiry was undertaken. The table which follows embodies the results of this inquiry and comprises—

(1) the cases which were notified from the beginning of 1909 till the 31st July, 1910. These are printed in ordinary type.

(2) the cases which were overlooked : these are printed in italics and distinction is made between such as are undoubted and those concerning which the evidence is not altogether complete. The latter are marked with an asterisk and are cases in which the symptoms were those of enteric fever but in which a Widal test either was not taken or if taken was negative.

Notes mainly concerning the symptoms of the persons attacked are appended to the table.

TABLE II.

Showing the number of cases of Enteric Fever in Oakenshaw arranged according to their (approximate) dates of onset. Those printed in italics were overlooked.

	Address.	Sex.	Age.	Approximate date of onset.	Date of Notification.	Result of Widal test.	Milk Supply.
1	17 Cross Row	F.	33	Jan. 20, 1909	Feb. 4, 1909	+	X
2	59 Old Rows...	M.	13	May 1, "	May 31, "	+	X
3	8 Cross Row	F.	20	" 15, "	" 29, "	+	X
4	10 Old Rows...	F.	23	" 16, "	" 26, "	+	X
5	142 " " ...	F.	20	June "	June 8, "	+	X
*6	74 Old Rows...	F.	21	" "	—	—	X
*7	72 " " ...	F.	6	July "	—	—	X Z
8	34 New Row...	F.	5	" 1, "	—	+	X
*9	50 " " ...	F.	10	" 1, "	—	—	X
10	2 Cross Row	M.	32	Sept. 23, "	Oct. 2, "	+	X
*11	138 Old Rows...	M.	39	Nov. 7, "	—	—	X Z
*12	5 New Row...	M.	15	Feb. 10, 1910	—	—	X Z
13	35 New Row...	M.	30	Mar. 17, "	April 1, 1910	+	X
14	29 Old Rows...	F.	18	" 25, "	—	+	X
15	86 " " ...	M.	30	" 28, "	—	+	X
*16	28 New Row...	F.	25	Apr. "	—	—	X
*17	46 " " ...	F.	25	" 8, "	—	—	X S
18	5 Cross Row	M.	32	" 10, "	—	+	X Y
19	28 Old Rows...	M.	7	" 14, "	—	+	X
20	144 Old Rows...	F.	13	" 14, "	May 11, "	+	X
21	48 New Row...	M.	6	" 17, "	—	+	X
22	60 New Row...	M.	25	" 17, "	July 1, "	+	X
*23	2 Institute St.	M.	9½	" 19, "	—	—	X
24	17 Cross Row	M.	11	" 20, "	May 10, "	+	X
*25	5 New Row...	M.	17	" 20, "	—	—	X Z
*26	45 " " ...	F.	4	" 22, "	—	—	X
27	11 New Row...	M.	15	" 24, "	May 11, "	+	X
28	25 " " ...	M.	9	" 25, "	" 9, "	+	X Z
29	15 Institute St.	M.	7	" 25, "	" 15, "	+	X
30	90 Old Rows...	F.	9	" 25, "	" 12, "	+	X
31	119 " " ...	M.	18	" 25, "	" 9, "	+	X
32	55 Old Rows...	F.	25	" 26, "	—	+	X Y
33	28 " " ...	F.	33	" 30, "	—	+	X
34	144 " " ...	F.	15	" 30, "	—	+	X
35	22 Old Rows...	F.	30	" 30, "	May 17, "	+	X
*36	10 Old Rows...	M.	3	May 1, "	—	—	X
*37	24 New Row...	M.	14	" 1, "	—	—	"none."
38	52 Old Rows...	F.	26	" 2, "	Yes, but no record.	—	X
39	91 Old Rows...	M.	6	" 2, "	—	+	X
40	61 New Row...	M.	7	" 3, "	May 15, 1910	+	X
41	140 Old Rows...	F.	16	" 3, "	—	+	X Z
42	23 " " ...	M.	2½	" 4, "	—	+	X Z
*43	2 Institute St.	M.	35	" 4, "	—	—	X
44	2 Colliery Farm	M.	7	" 4, "	May 12, "	+	X
45	21 New Row...	M.	6	" 4, "	—	+	X
46	14 New Row...	F.	25	" 4, "	May 17, "	+	X
*47	105 Old Rows...	F.	16	" 4, "	—	—	X
48	27 New Row...	M.	19	" 4, "	May 13, "	+	X
49	136 Old Rows...	F.	31	" 4, "	" 13, "	+	X
50	14 Institute St.	F.	50	" 6, "	—	+	X

—	Address.	Sex.	Age.	Approximate date of onset.	Date of Notification.	Result of Widal test.	Milk Supply.
51	134 Old Rows...	F.	11	May 6, 1910	May 15, 1910	+	X
52	48 New Row...	M.	5	" 8, "	—	+	X
*53	79 Old Rows...	F.	25	" 8, "	—	—	Y
54	11 New Row...	M.	20	" 8, "	May 13, "	+	X
*55	9 Cross Row	M.	4	" 8, "	—	—	X
56	33 New Row...	M.	34	" 8, "	May 22, "	+	X
57	26 Old Rows...	M.	11	" 8, "	—	+	X
58	26 Old Rows...	F.	21	" 8, "	May 17, "	+	X
*59	26 Old Rows...	M.	6	" 8, "	—	—	X
60	126 Old Rows...	F.	22	" 8, "	May 22, "	+	X
61	9 Old Rows...	F.	64	" 10, "	—	—	Z
62	26 Old Rows...	F.	40	" 12, "	May 19, "	+	X
*63	2 Colliery Farm	M.	5	" 15, "	—	—	X
*64	136 Old Rows...	M.	3	" 20, "	—	—	X
*65	108 " " ...	M.	30	" 22, "	—	—	Y
*66	16 Cross Row	F.	50	" 29, "	—	—	Y
67	9 New Row...	M.	37	" 29, "	June 12, "	+	X Y S
68	31 Old Rows...	M.	5	" 30, "	—	+	Y
69	14 New Row...	F.	24	" 30, "	June 9, "	+	X
70	136 Old Rows...	F.	16	" 30, "	" 11, "	+	X
*71	9 Old Rows...	M.	4	June 6, "	—	—	Z
*72	31 " " ...	M.	16	" 8, "	—	—	Y
*73	102 " " ...	F.	27	" 8, "	—	—	X
74	81 Old Rows...	M.	4½	July 17, "	July "	+	X

Notes.

- 1, 4, 12, 13, 48, 54, 60 were fatal cases.
6. "Ailing after confinement": went away for a holiday: absent 1 week when doctor in attendance diagnosed typhoid fever and sent her into hospital. She drank a great deal of raw milk before her confinement.
7. Fever and diarrhoea: pains in head and back: in bed 1 week: off school 1 month: "played in and out of 74 Old Rows."
8. "Slow fever": onset slow: headache; no diarrhoea: ill 5 weeks.
9. "Slow fever": headache: short cough: no diarrhoea: ill 6-7 weeks "in a low way."
11. "Strong influenza": malaise 2 weeks, in bed 4 weeks.
12. Said to have died from appendicitis.
14. Illness came on gradually: diagnosed as "ulceration of stomach and bowels."
15. "Influenza and pneumonia": in bed 9 weeks; patient is a brother of X the owner of the suspected milk business.
16. Wife of X the owner of the dairy from which most of the houses affected were supplied.
17. "Out of sorts" for 2 weeks: in bed 3 weeks: cough: no diarrhoea.
21. In bed 3 weeks: pains in back and abdomen: epistaxis: constipation.
23. "Influenza."
25. Insidious onset: epistaxis: slight cough: off work 7 weeks (in bed 3): brother of No. 12.

26. Ill 1 month : fever, delirium : severe diarrhoea 1 week.
32. Sister-in-law of patient No. 20.
33. Mother of patient No. 19.
34. A sister of patient No. 20.
36. "Influenza" : child of patient No. 9.
37. Headache and pains in the back : diarrhoea : in bed 1 month.
38. Her little boy had severe colic about Easter. She took him to Newcastle, but was there only 2 or 3 days when she herself fell ill with typhoid and was removed to hospital. She had been "out of sorts" for 2 weeks before going to Newcastle. This woman is related to patients 10, 12, 25, 26.
39. Typhoid suspected at time of illness : abdomen swollen : headache : pains in back : no diarrhoea.
41. In service at 31 New Row where milk was obtained from X and Z.
42. "Ill 2-3 weeks" : "lay in a slumbering condition."
43. Off work 7 weeks : headache : "fulness in stomach" : diarrhoea.
45. "Slow fever" : epistaxis : ill 7 weeks (in bed 1 month).
47. Felt "run down" : in bed 2 weeks : diarrhoea : severe pains in back.
48. Met with accident at the pit on April 16th. After the accident he lived mainly on a milk diet ; and progressed favourably up to May 4th when he took typhoid. The diagnosis was confirmed by post-mortem examination : patient was uncle to No. 28.
50. Fever, pains in head and back : diarrhoea, 1 week : insidious onset : recovery : patient is sister-in-law of No. 45.
52. Pains in belly : severe diarrhoea : took ill as brother (No. 21) was recovering.
53. All the symptoms of typhoid but Widal negative.
55. Stomach pains : diarrhoea : "slept a great deal" : in bed 3 weeks : typhoid was suspected at the time.
57. Brother of No. 58 : "influenza" : pains in back : no diarrhoea : in bed 3 weeks.
59. Brother of No. 58 : "influenza" : pains in back : no diarrhoea : in bed 3 weeks.
61. "Bad influenza with inflammation of the belly especially on the right side." Slight cough : no diarrhoea : ill 3 months : this patient is the grandmother of No. 30.
62. The mother of Nos. 57, 58 and 59.
63. Ill one week when brother (No. 44) was in hospital : severe diarrhoea.
64. Suffered from influenza-like illness while the mother (No. 49) was in hospital.
65. Off work 3 weeks with pains in abdomen : headache and backache : no diarrhoea : patient was a frequent visitor at 119 Old Rows (No. 31).
66. Malaise 1 week followed by severe diarrhoea : pains in head and back : patient is an aunt of No. 2.
68. In bed 3 weeks : abdominal pain and fulness : cough : diarrhoea.
69. Sister of No. 46.

70. Was removed to No. 32 Old Rows, where she remained 1 week before being removed to hospital.
71. In bed 5 weeks: pains in belly and fulness: short cough: no diarrhoea: patient is a grandson of No. 61.
72. Illness diagnosed as "catarrh of stomach and bowels": diarrhoea.
73. In bed 6 weeks with "inflammation of bowels" following confinement.

So far as could be ascertained there were altogether 74 cases—11 of which occurred in 1909 and the remainder in 1910.

A large proportion of these—42 in all—were overlooked. Of these overlooked cases 17 reacted positively to the Widal test and were classified as "certain." 25 either were not tested at all in this respect or were found to react negatively. These were regarded as "doubtful."

The following table brings out more clearly the explosive character of the outbreak in the early part of May, 1910—the cases being tabulated according to dates of onset.

TABLE III.

Showing the number of cases of Enteric Fever in Oakenshaw week by week from March 27th to June 12th, 1910.

Week ending.	Total number of cases—including notified and overlooked.	Notified cases of Enteric Fever.	Cases of Enteric Fever which were overlooked.	
			Certain.	Doubtful.
1910.				
April 3	1	—	1	—
" 10	2	—	1	1
" 17	5	2	2	1
" 24	5	2	—	3
May 1	10	5	3	2
" 8	23	11	7	5
" 15	3	1	—	2
" 22	2	—	—	2
" 29	2	1	—	1
June 5	3	2	1	—
" 12	3	—	—	3

Of the 74 persons attacked 7 died; the fatality therefore was 9·5 per cent. All these deaths occurred among persons of ages ranging from 15 to 33.

CAUSE OF THE OUTBREAK.

Of the various explanations offered as to the origin of the epidemic, that which appeared to find most favour locally, attributed it to infection borne by the wind from the night-soil tip near New Row, but nearer scrutiny failed to reveal anything that would bear

out this suggestion—such, for example, as a significant grouping of the cases in the neighbourhood of the tip.

The possibility of infection by water was also considered and dismissed. The water supply of Oakenshaw is the same as that of the rest of the district and, as has been already stated, is derived from the mains of the Weardale and Consett Water Company.

No causal relationship could be established with the consumption of shell fish or watercress. Indeed these articles of food are scarcely if at all used in Oakenshaw.

Inquiries were also made with regard to meat, mineral water, and vegetables, but with negative results.

Inquiry however as to the possibility of relationship of the fever with milk supply, revealed the fact that practically all the cases occurred in association with one particular supply. This is shown in Table II and also in the table which follows.

Oakenshaw obtains its milk from various sources, but mainly from three farms which in the following table are designated X, Y, and Z.

In the first line of the table is shown the extent of each purveyor's round, and underneath in the second line, the corresponding number of houses in which cases of enteric fever occurred. The figures relate to April and May, 1910, except as regards invaded houses where they relate to the month immediately preceding the onset of the patient's illness.

TABLE IV.

Table showing the sources of the Milk Supply of Oakenshaw, together with the total number of houses invaded by Enteric Fever and also the number invaded in connection with each source of supply.

	Total number of houses in Oakenshaw.	Number of houses occupied.	Number of houses supplied by										Number of houses in which there was used	
			X		Y		Z		S		T		Only tinned milk.	No milk.
			Alone.	In part.	Alone.	In part.	Alone.	In part.	Alone.	In part.	Alone.	In part.		
	250	242	72	13	44	11	53	14	—	4	1	1	42	7
Number of houses invaded by enteric fever.		57	41	8	6	1	1	6	—	2	—	—	—	1

It thus appears that of the inhabited houses in Oakenshaw 85, or 35.1 per cent., were supplied wholly or in part by X; 55, or 22.7 per cent., by Y; and 67, or 27.7 per cent., by Z. In 2.9 per cent. no milk was used and in 17.4 per cent. only tinned milk.

Altogether the outbreak involved 57 houses and from the table it is seen that 41 of these obtained the whole and 8 a moiety of their milk from X. On the other hand only a few cases occurred in houses supplied by either Y or Z.

Further, Y and Z supply houses outside Oakenshaw but no case of enteric fever was notified from any of these. X's "round" is confined entirely to Oakenshaw. Houses in which only tinned milk was consumed remained free from the fever, though these included some of the most insanitary houses in the village. This would seem to indicate that the slight involvement of the Y and Z supplies was due rather to "interdealing," of which there is a good deal, than to contact infection, at least it inclines one to the view that in this particular outbreak, at any rate, contact played a very unimportant part in the spread of the disease.

If regard be had only to undoubted cases the evidence against X is still more overwhelming as with only three exceptions all of these occurred in X's round.

The amount of milk delivered daily to each household varied, but a half to one pint may be taken as an approximate average. It was generally found that the member of the family who fell ill was the one who "drank most milk," but even so the quantity consumed must have been, and in fact was, in the majority of cases exceedingly small.

The following table, which shows the heavy proportional incidence of the fever on females and children is an additional argument in support of the conclusion that the infection was milk-borne.

TABLE V.

Showing the age-incidence of Enteric Fever on males and females in the Oakenshaw Outbreak.

—			Under 5 years.	5 —	10 —	15 —	20 —	25 —
Males	...	...	6	13	4	6	1	10
Females	...	...	1	3	3	5	7	15

It is of interest to note here the preponderance of male children attacked. I have no figures as to the relative proportion of males and females in Oakenshaw at the present time, but there is no reason to suppose that it differs materially from that obtaining for the whole district in 1901, which is set forth below.

TABLE VI.

Showing the age and sex distribution of the population of Willington Urban District at the 1901 Census.

—			Under 5 years.	5 —	10 —	15 —	20 —	25 —
Males	...	...	516	521	474	455	380	1,730
Females	...	...	564	482	461	380	331	1,593

In view of the fact that X's milk was mainly responsible for the outbreak it remained to discover how it had become infected. The X farm is a small holding of 12 acres occupied by Mr. X (53 years).

The cowshed, which is about a quarter of a mile away from the dwelling house, is of recent construction and apparently well-cared for. Three cows are kept—up “till recently” there were four—of good stock, and at the time of my visit were in excellent condition. They were moderately clean about the flanks and udders. The water used at the farm is from a spring. A sample was analysed and pronounced to be excellent drinking water.

The other members of Mr. X's household are his wife (49 years) and one daughter (17 years). There are two sons both married and living in Oakenshaw.

The younger son, who is 25 years of age, carries on the milk business with the assistance of his mother.

The mother helps by washing the vessels—rinsing and scalding them in the ordinary way—while the son does all the milking and selling. Only these two—mother and son—have anything to do directly or indirectly with the handling of the milk from the time it leaves the udder until it is delivered to the customer: and so it has been for the last 12 years.

The long association of X with Oakenshaw—since 1896—and notwithstanding this, the comparative immunity of Oakenshaw from enteric fever prior to 1909 made it appear probable that some new factor, possibly a “carrier,” had been introduced about the end of 1908. As far as can be learned the outbreak began in January, 1909, and in connection with the X supply. It was thought that the required explanation was to be found in an illness which young Mr. X had about the middle of 1908, and which was diagnosed at the time as a “bad cold” which had “struck in” causing “inflammation of the lungs and bowels”—a history strongly suggestive of enteric fever. Specimens of his urine and fæces were obtained in August, 1910, and examined for typhoid bacilli by Dr. Ledingham of the Lister Institute but with negative results.

From the mother no history of sickness could be got beyond a “bad bilious attack about 4 years ago.” The illness lasted a week but she took little notice of it as she is “subject to these attacks.”

However, samples were taken of her urine and fæces at the same time as from the son, and examined by Dr. Ledingham and the fæces were found to contain large numbers of typhoid bacilli. These bacilli were still present when her fæces were again examined in the following December.

That Mrs. X therefore was the source from which the milk was infected seems to be the logical conclusion.

It is perhaps idle to speculate how, and when, Mrs. X first became a carrier, and whether her condition is “active” or “passive.”

The X business was started in 1896. Unfortunately, there is no record to show whether the X milk was related causally with any of the cases which occurred in Oakenshaw between 1896 and 1908.

The only evidence suggesting the possible existence during this period of an unusual influence is in the following table :—

TABLE VII.

Showing the seasonal incidence of enteric fever in Oakenshaw as compared with other parts of the urban district during the periods 1891-1895, 1896-1908, 1909-10 (July 31st).

—	Oakenshaw.			Other parts of the urban district.		
	1891-1895.	1896-1908.	1909-1910 (July 31).	1891-1895.	1896-1908.	1909-1910 (July 31).
January ...	—	2	—	2	5	2
February ...	—	2	1	2	4	1
March ...	—	1	—	—	7	—
April ...	—	2	1	3	5	—
May ...	—	1	23	—	3	1
June ...	—	—	4	1	1	—
July ...	—	—	2	3	3	—
August ...	1	1	—	8	18	—
September ...	2	1	—	12	35	3
October ...	7	—	1	21	31	1
November ...	1	1	—	7	15	1
December ...	1	1	—	9	15	—

Previous to 1895 the seasonal incidence of enteric fever in Oakenshaw was of the usual type and corresponded with that in other parts of the urban district. The bulk of the cases occurred in the autumn months of the year.

In the subsequent period 1896-1908 a marked change is observed. Whereas outside Oakenshaw the incidence remained the same—by far the greater proportion of the cases (82 per cent.) occurring in the second half of the year—in Oakenshaw the position was reversed. Here the majority of the cases (67 per cent.) are now found in the first half of the year and only a small percentage in the second half. Similarly in the 1909-1910 outbreak nearly all the cases were confined to the first six months of the year.

It is true the figures are small and hardly admit of definite conclusions being drawn, but taken in conjunction with the history of periodic bilious attacks which Mrs. X. gives, they lend colour to the view that this woman may have been a carrier for a considerable number of years. If this view be accepted the question arises why she did not occasion any serious epidemic prior to 1909. She assures me that there has been no change in her dairy routine during all these years. Nor can she tell of any recent indisposition which would have the effect of making her less careful in her work. It may be held that the explanation of the facts is to be found in the known "intermittency of the carrier." The possibility, however, that her discharges somehow acquired an increased potency for infection about the beginning of 1909 deserves consideration. Here it is that the son's illness may be of significance. It seems probable that the illness which the son contracted in 1908 was a mild attack

of enteric fever and it may perhaps be that he received the infection from his mother. Mrs. X. nursed him. It is just possible that at this time Mrs. X. became reinfected or passively superinfected with a fresh typhoid bacillus from the patient—with her own bacillus, perhaps rendered more virulent by passage through the susceptible body of her son.

The outbreak subsided before its cause was discovered and before action was taken by the local authority. As soon as suspicion settled on Mrs. X, instructions were given by the medical officer of health that she should have nothing more to do with the handling of the milk or of the milk vessels, and I am informed that these instructions have been faithfully observed. Since then no further cases have occurred.

In conclusion I have to acknowledge the cordial assistance given to me during this inquiry by Dr. Brown, the medical officer of health, and Mr. Gardner, the inspector of nuisances. I have also to thank the clerk of the urban district council. To Dr. Brewis I am indebted for details concerning many of his cases and for numerous specimens of blood. My acknowledgments are also due to Dr. Eustace Hill, medical officer of health for the county of Durham, and to his assistant, Dr. Smedley, for information readily placed at my disposal.

THOS. CARNWATH.



