TYPHOID FEVER AND CHRONIC TYPHOID CARRIERS.*

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TYPHOID Fever has shown in England and Wales during the three and a half decades that have elapsed since it was distinguished in the Registrar-General's returns from Typhus Fever, a continuously decreasing mortality :—

Periods.	Death rate per million living.
1871-1880	322
1881-1890	198
1891-1900	174
1901-1905	110

While the mortality has decreased, however, the fatality (or case-mortality) has remained practically stationary. Thus, in the London Fever Hospital, in 1848-57, the fatality rate was 17·3 per cent.; in the Metropolitan Asylums Board Hospitals in 1871-97 the rate was again 17·3 per cent., and in the single year 1897 it was 18·7 per cent.

Upon the discovery of the bacillus of typhoid fever in the eighties, it was anticipated that control of the disease would become simple; the causal bacilli were supposed to enter, occupy and leave the body as an orderly army, leaving no stragglers, and recovery of the patient was held invariably to connote the death and disappearance of the bacilli.

If this were always so, the control of such a disease would be comparatively simple, and the knowledge that the typhoid organism is a flagellate water-living parasite, leaving the body by way of the solid or liquid excretions during the clinical continuance of the disease, and completing its life history by a more or less prolonged saprophytic existence in organically polluted soil or in water, pending its introduction into the intestinal tract of its next host, would sufficiently explain the etiology of the disease in its well-known phases as water-borne, milk-borne, oyster-carried, and so on.

But allowing for the fulfilment of these conditions in the majority of instances, there still occurred a residuum of cases which did not

fall into line with these routine conditions, and fuller knowledge of the life-history of the causal parasite has become necessary in order to account for these aberrant outbreaks.

The easy habit has unfortunately arisen of referring obscure sporadic outbreaks to general insanitary conditions, and the smoke test has no doubt led to the reconstruction of much innocent drainage, the cost of which might have been better expended.

That the major portion of the decline in the prevalence of typhoid fever has been due to general improvement in drainage and water supply, is probably, in view of the nature of the disease, incontrovertible, and this obvious relationship has tended to obscure the validity of personal transference, mediate or immediate, of infection.

Two things became, however, in the course of time apparent, one, that owing to enhanced resistance to infection in certain individuals, attacks in such nearly immune persons might be represented by very slight or negligible symptoms, so that neither the patient nor his friends, nor even his medical attendant would have reason to suspect the real nature of his illness. Hence arise "ambulant" cases, and "missed" cases, affording far greater opportunities for the distribution of infection, owing to the ignorance of any need for, and consequent lack of, precautions; the other, that after apparent recovery, some of the bacterial diseases may persist in the patient, who, himself immune, may become a "carrier" of the disease, and be potentially infective towards others.

An account of two institution outbreaks traced to the same "carrier."—The occasional persistence of the *B. typhosus* in the human body over long periods has been recognised for some years, and the possibility that this condition might afford the explanation of obscure outbreaks was suggested by Horton Smith, in his Goulstonian Lectures in 1900 [16]. At that time it was generally accepted that the *B. typhosus* could be demonstrated in the stools, if care was taken, during the first and second and early part of the third week of the disease, and possibly during the early part of the relapse. Later than this it could not be demonstrated by the laboratory methods then available. It was known, however, from the experiments of Chiari [4], that the bile in the gall-bladder contains the *B. typhosus* in the majority of typhoid cases, and often in pure culture.

* From the Annual Report of the Medical Officer of Health of Bristol, 1907.

It was naturally supposed at first that, as the fever passed away, and as health returned, the bacillus, the cause of the disease, would disappear from the tissues also, and this was demonstrated to be the case in some of the earliest observations. But the experiments of Blackstein and Welch [1] showed that sometimes at least the typhoid bacillus might remain for much longer periods; experimentally, in rabbits, it was found in the bile 128 days after the date of inoculation, and this suggested that the same thing might occur in man. Between 1894 and 1896, Buschke [3], Sultan [18] and Bruni [2] quoted cases in which the bacilli were found in the pus from bone abscesses, in two instances six years after the primary fever, and in one case seven years after. Hunner [7] quotes cases in which cholecystitis was shown to be accompanied by the presence of the *B. typhosus* in pure culture, in one case three months after the fever, in another eight months, and in a third after an interval of seven years. Von Dungern [6] records a case in which, fourteen and a half years after the attack of typhoid fever, the bacilli were still present in pure culture in the cystic contents [5].

These facts have hitherto remained largely ignored in their epidemiological relationship, partly because the assumed rarity of their occurrence suggested that they were merely bacteriological curiosities, and partly because the isolation of the *B. typhosus* from the faeces was at that time not only difficult but very uncertain. In 1906, however, owing to the continued prevalence of sporadic typhoid in South Germany, the subject was taken up with the advantage of modern and more certain laboratory methods, and Klinger [10] found that persons in apparent health can harbour typhoid bacilli and excrete them. The German observers divide "carriers" into two classes:—

(1) "Acute carriers," who have a shown no symptoms, but, after being in direct contact with patients, may carry and excrete bacilli for a short time and in small numbers.

(2) "Chronic carriers," who have a short or a long time before gone through a regular attack of typhoid, and may excrete for months or years more or less pure cultures of typhoid bacilli.

The "chronic carriers" are obviously the most dangerous class; about four per cent. of typhoid patients appear to become carriers;

the condition is most common in women, and the bacilli apparently are harboured in the bile in the gall-bladder or in the intra-hepatic bile passages, whence intermittently they are discharged and excreted with the faeces. This condition may persist for as long as twenty-nine years [5]. When these chronic carriers are engaged in the preparation of food, or in dairy work, they are apt to give rise to intermittent local outbreaks of typhoid fever, probably by contamination of the food with the hand after defaecation or micturition. Kayser [8] quotes the case of a proprietress of a bakehouse at Strasburg, who prepared the meals for the employes, where each journeyman developed typhoid soon after arrival; her stools were full of bacilli, and she gave a distinct Widal reaction (1—100). Soper [17], of New York, records the case of a cook, who, in five years, lived in four families and gave rise to twenty-eight cases; the bowel discharges furnished practically pure cultures of the typhoid bacillus, and the extrusion of bacilli in her case was shown to be intermittent. A. and J. C. G. Ledingham [11] record thirty-one cases in fourteen years at an institution in Scotland, finally traced to carrier cases.

I believe it will be found that the two instances I am about to narrate are the first recorded outbreaks in England traced to the influence of a typhoid "carrier."

I.—OUTBREAK OF TYPHOID FEVER AT THE BRENTY CERTIFIED INEBRIATE REFORMATORY, BRISTOL.

In November, 1906, my attention was first called to an outbreak of typhoid fever at this institution. The general circumstances of the outbreak have been so fully detailed in a Parliamentary paper [14] that the case will now be presented as briefly as possible.

The essential facts are these: the Home contains 240 inmates and 24 resident officers; it has been opened since 1899, and typhoid fever first appeared in 1906. The water supply is good and the drainage presented no defects able to account for the occurrence or distribution of the disease. No cases of typhoid fever existed in the neighbourhood. In September, 1906, a kitchen helper developed typhoid, and in November three more cases occurred (Chart I.). These cases already suggested carriage by milk, for one was a female inmate who received an extra allowance of one pint of milk daily as she was nursing; another was the gardener's wife, who lived in

a detached cottage on the premises and received only milk from the institution; the third was an outdoor policeman, who received an allowance of milk for his tea; but no explanation of the origin of the initial case was forthcoming. In January, 1907, the policeman's wife sickened, probably from nursing him; they lived in a cottage off the estate.

Then there was a lull until May, 1907, when fresh cases occurred, continuing through July, August, September, October and November, in small groups and at varying intervals. Already in November, 1906, the Home Office medical inspector had installed a milk steriliser, and all milk was sterilised before use and then stored in the dairy until wanted. The evidence in the 1907 cases was still stronger against the milk, which evidently had opportunity of contamination *after* sterilisation.

On the reappearance of the disease in May, 1907, the Home Office medical inspector and the medical officer of health for South Gloucestershire (Dr. Bond) made a careful examination of the premises and discovered that rats had free communication with the dairy and food stores, and it was supposed that they carried infection in from the sewers. Accordingly the food stores and dairy were made rat-proof. This was practically completed by the end of August, but still the cases dropped in steadily month by month.

The problem was at this point when I was invited by the Bentry Committee, in the autumn of 1907, to inquire into the renewal of the Bentry outbreak. I commenced this inquiry in November, 1907. Dr. Branthwaite and Dr. Bond made me fully acquainted with the results of their careful and detailed inquiries and left me a free hand. As a matter of fact, they had narrowed the issue down so closely, and had excluded so many possible sources of infection, that my task was comparatively easy.

I was at once struck by two facts. First, the obvious carriage of infection by milk; secondly, the certainty that this must become infected *after* sterilisation; whence followed the inference that, as rats and other possibilities had been excluded, the agent distributing infection might be a "carrier" case dealing with the milk.¹ I then learned, with the aid of the chairman of the Bentry House

Committee, that an inmate employed as cook and dairymaid, Mrs. H., had suffered, in January, 1901, from a severe attack of typhoid, from which she had apparently recovered. She is a woman aged 50, to all appearance in perfect health. She was admitted to Bentry in April, 1906, and was employed in kitchen work up to October 13, 1906, when she was entrusted also with the dairy work, which she continued up to November, 1907.

The milk, after sterilisation, is stored in the dairy, whence it is measured out for the various "villages" by means of a hand-dipper. All the milk passed through her hands. In the passage leading from kitchen to dairy is a w.c., accessible to the kitchen workers, containing a lavatory basin which was not in use. On November 13th, I requested that Mrs. H. should be absolutely excluded from all kitchen and dairy work, and isolated as "suspect" until I could arrange for a pathological examination of her blood, urine and stools. This was done. At the same time I ventured the opinion that, allowing for the incubation period of typhoid fever, no further case should occur. The last case occurred on November 25th, twelve days after her isolation commenced; and the institution has remained free up to the present time (May, 1908).

Evidence of Milk Conveyance.—I have summarised the evidence implicating milk on Charts 2 and 3. Chart 2 shows that of the eleven female inmates attacked, three were employed in the kitchen, two as dining-room maids, and three in the tea-house, all thus having access to milk. The three other female inmates attacked were the only three who, as they were nursing, received an extra supply of one pint of milk. The baby (hand-fed) of one of these was also attacked. Three female officers were attacked, including the matron, whose illness dated from a tea party on July 31st, 1907. On this occasion a visitor from a Bristol institution, where there was no typhoid, called and shared with the matron, a female officer, and the doctor's little boy, a meal of which clotted cream, skimmed off the sterilised cooled milk by Mrs. H., formed part. The officer refused this, the matron and visitor, who ate some, sickened simultaneously on August 20th. The little boy ate heartily but remained well. Previously to this, however, on June 20th, 1907, he had developed a high temperature, which continued until June 27th, and was followed by considerable depression and slow recovery; his general

(1) My attention had been especially redirected to this possibility by Savage, "Recent work upon the Bacteriology of Typhoid Fever in its relationship to Preventive Medicine."—PUBLIC HEALTH, October, 1907.

BRENTY.

CHART II.

DIAGRAM SHOWING PLACE-DISTRIBUTION OF ATTACKS ON FEMALE INMATES.

FEMALE INMATES ATTACKS.

This Diagram shows the grouping of the 11 female inmates according to their place of abode and according to their work. The grouping apparently suggests nothing as to place-infection but it is noticeable that every female inmate attacked either had an extra allowance of milk, or had special access to food (including milk) in the administration (as dining room maids), in the kitchen, or in the tea house. The only persons living and sleeping in 4 and 5 who were attacked were (6) and (21) both working in the tea house. Nos. 2, 7 and 15 are the only female inmates receiving extra milk allowance and all three were attacked. The three Female Officers attacked were the Matron (No. 19) whose attack dated from the Tea Party on July 3 on which date a Visitor who stayed to tea also contracted Typhoid. Miss H. (No. 13) who slept in No. 5 and was Kitchen Officer; and Miss P. (No. 27) who slept in No. 3 and worked generally in Female Village serving meals, etc.

CHART III.

DIAGRAM SHOWING PLACE-DISTRIBUTION OF ATTACKS ON MALE INMATES AND OFFICERS.

BRENTY.

MALES ATTACKS.

The Inmates 9, 17, 18 and 22 were the only ones engaged in tea-making or in attendance upon Officers' Mess at the time of their attack. The Officers living-out who were attacked, all had tea-milk regularly supplied. None of the nine Officers living-out who had no tea-milk supplied were attacked.

appearance during this attack was consistent with a masked attack of typhoid fever, although he gave a negative Widal on July 21st and on December 10th.² If this was really a minimal attack of typhoid, it may account for his immunity. Chart 3 shows that all the four male inmates attacked were directly employed in the officers' mess-room, where they had access to milk. Cases 17 and 18 took on Case 9's duty and sickened in turn. The three officers who lived out and were attacked all had tea-milk regularly supplied; one workman who had milk served out to him once on September 28th, 1907, but denies drinking it, sickened on October 14th. *Of the nine officers who lived out, but received no milk, not one sickened.*

**Pathological Investigation.*—The laboratory results obtained in the case of Mrs. H. are here summarised: (A) On November 18, 1907, two samples of her blood both gave the following reactions (Widal):—

Dilution	Time	Reaction
1 in 10 ...	60 min. ...	Loss of motility; agglutination complete.
1 „ 25 ...	„ ...	Loss of motility; agglutination present but incomplete.
1 „ 50 ...	— ...	No change.

The urine yielded neither *B. typhosus* nor *B. coli*. The faeces yielded no organisms resembling the *B. typhosus*, but chiefly *B. coli*. Generally the excreta appeared to be normal. (B) On November 29th, 1907, the faeces similarly yielded no organisms resembling the *B. typhosus*, and were apparently normal. (C) On December 20th, as Mrs. H., after slight abdominal pain, had passed a light brown to yellow brown loose stool of uniform soft consistence, not unlike an early typhoid stool, containing no excess of mucus, blood or fat, opportunity was taken to make a third examination. Typhoid bacilli, giving all the typical reactions, were upon this occasion isolated from the faeces. The bacilli were freely motile and reacted to immune serum thus:—

Dilution	Time	Reaction
1 in 25 ...	30 min. ...	Loss of motility; complete agglutination
1 „ 200 ...	„ ...	Loss of motility; complete agglutination

The intermittence during November is noteworthy. Upon the failure to recover the *B. typhosus* in November, it was decided to

make additional examinations of certain inmates who had more or less to do with food preparation or dairy work. Sixteen blood examinations and twelve examinations of faeces were carried out, but failed to demonstrate another “carrier.” In the faeces of the typhoid convalescents examined, the *B. coli communes* exhibited many alterations from their usual reactions. They rarely were quite typical. One or more of the biological tests were always less pronounced than usual.

Methods.—The faeces were collected free from urine and placed in vegetable parchment paper and then in stoneware jars. They were conveyed to the laboratory as rapidly as possible. On arrival, ten platinum loopfuls, taken from different parts of the material, were transferred to a tube of sterile normal saline solution. After shaking, a loopful of this mixture was placed in a broth tube. From this latter tube a loopful was taken and put into a tube containing the following medium: ordinary beef broth with 0.1 per cent. sodium taurocholate and 1 in 1,500 malachite green (Grübler). In isolating the *B. typhosus* from material other than faeces, the Loeffler malachite green gelatine medium has been used with successful results. With the faeces, however, the green colour soon fades, organisms other than the *B. coli communis* grow well, and the plating is slow and less satisfactory. Hence the use of the present medium. Klein [9] has suggested this manner of culture for the isolation of organisms from shellfish. McWeeney (1908 meeting of the Pathological Society of Great Britain and Ireland) showed cultures obtained in a similar way, but without the addition of the bile-salt. After twenty-four hours' growth in the malachite green broth, a loopful of the culture was transferred to a second broth tube, and a series of six plates were inoculated by spreading a loopful of this culture over the surface or allowing a few drops to run over the surface. The plates were then left partially uncovered in the 37° C. incubator for half an hour, and then fully covered and inverted. As a rule five McConkey bile-agar plates and one Conradi-Drigalski plate were used for each sample. Twenty-four hours later the colourless, non-lactose colonies were examined for motility in a hanging drop preparation, and, after further plating, were transferred to tubes containing the following media: glucose broth, mannite broth and lactose broth. When

(2) See PUBLIC HEALTH, July, 1907, p. 607: “Some difficulties in preventing Personal Infection in Enteric Fever,” for interesting points relating to mild attacks of typhoid fever in children.

* Prof. Walker Hall, Professor of Pathology, Bristol University College Medical School, and Pathologist to the Bristol Royal Infirmary, is responsible for the laboratory results.

colonies were obtained which formed acid, but did not produce gas in these media, they were further cultivated in dulcete, saccharose and sorbite broths; and in litmus milk, neutral red agar, glucose-agar, Barsiekow's medium with glucose, and with lactose; and in peptone water for the indol reaction. The organism which gave the distinct typhoid reactions was then treated with serum from cases attacked in the present epidemic and with immune horse serum.

Danzysz Virus.—As this had been used in an attempt to kill off the rats infesting the premises, and it had been suggested that this might have some causal relationship to the outbreak, a rat was forwarded in November, 1907, to Professor Hewlett, with negative results. Bainbridge has recently stated that Danysz's bacillus and the bacillus of mouse typhoid are practically identical. These organisms have been considered non-pathogenic for man, but an outbreak of fatal enteritis has followed the consumption of food contaminated by similar virus. Although the substance is sold publicly as harmless, it is evident that careful handling is necessary.

Swine fever broke out on two occasions, viz., in July, 1906, and from March to September, 1907. This was dealt with under veterinary advice. There is generally supposed to be no connection between human and pig typhoid, but we should have liked to make some inquiries as to the possibility of infection from "carrier" to pig, and generally into the relationship between human and pig typhoid. However, as the pigs had been destroyed before the investigation was taken up, no opportunity offered itself.

Confirmation of causal influence of carrier by evidence from a previous outbreak.—The belief that Mrs. H. was the actual cause of the Brentry outbreak, if not proved by the foregoing sequence of events, at least provided a working hypothesis which stood the test of experiment. The necessary control experiment was found by tracing back her history to a period (1904) when she was in service at another institution, where a similar outbreak occurred.

II.—THE OUTBREAK OF TYPHOID FEVER AT GROVE HOUSE HOME FOR GIRLS, BRISLINGTON, NEAR BRISTOL.

In 1904, this Home was occupied by thirty-six girls (aged from 5 to 15) boarded out by the Bristol Guardians and supervised by four

officers. Typhoid fever first appeared in the third week of May, and from that time until the end of September, when the Home was closed, cases continued to occur in crops at intervals of a week or more (Chart 1). Twenty-five cases developed typhoid fever, eight other suspicious cases occurred, and two deaths resulted. Thus nearly all the girl inmates were attacked. How the first case arose it was found impossible at the time to ascertain; there had been no typhoid in the district for months.¹ The cases occurred in groups at intervals, many cases were very mild, the water supply from the Bristol Waterworks Company was above suspicion, there were no other cases among the dairyman's other customers, nor was the manner of the outbreak suggestive of contamination of water or milk supplies; no defects in the drains were discoverable likely to have any influence in causation. No cases occurred during 1904 in the district except at this Home. Every possible means were taken to control the disease by disinfection, boiling of milk, cleanliness, and precautions as to food, all without avail. The medical officer of health, warned by previous experience in diphtheria, shrewdly suspected a human "carrier," and the girls, *but not the staff*, were systematically examined by the Widal test. Still the outbreak went on, and did not cease until the home was closed at the end of September and the children boarded out at various other homes. The cook left to take a private situation. This history might have been held to afford a fairly complete example of an outbreak of typhoid fever due to "insanitary" local conditions. It now appears, however, that on February 3rd, 1904, Mrs. H., *the same woman who was in 1906 cook and dairymaid at Brentry*, had been transferred from the Bristol Workhouse to assist at Grove House, Brislington, in the kitchen. She proved so satisfactory that on May 2nd she was taken on as a paid servant, with rations and lodgings. Her duties were to generally assist in the kitchen and to cook; she received the milk from the tradesman, and attended to its boiling and preparation for consumption by the children. All the milk was kept in the kitchen.

On May 16th the first case of typhoid appeared. Cases continued through June, July, August and September. The cook left to take a private situation on September 2nd.

(1) Annual Report of the medical officer of health (Dr. J. C. Heaven) to the Keynsham Rural District Council, Somerset, for the year 1904.

The last case was notified twenty days after, on September 22nd, and the Home was closed at the end of September.

Quiescent Periods.—The occurrence of quiescent periods during which either no typhoid bacilli are extruded or, if extruded, fail to become effective, has been noticed by more than one observer. In this connection we may draw attention to the fact that both the Bristol outbreaks presented a period—at Brentry lasting from December to May, at Brislington from February to May—during which the carrier, although engaged in her usual occupations, proved ineffective; but from May onwards in each year the power of infection was markedly developed. This “close” time for typhoid carriers roughly corresponds to the seasonal incidence of typhoid prevalence in communities. As pointed out above, examination of Mrs. H.’s stools, which proved negative during November, gave a positive result on December 20th. In January, 1908, an examination proved negative, and three examinations of Mrs. H.’s dejecta during February, 1908, also failed to disclose the presence of the *B. typhosus*; it continued absent until the middle of April, when it was again demonstrated in the stools. Allowing for the normal incubation period of typhoid fever, the outbreak would probably have recommenced in May, as it did at Brislington in 1904, and at Brentry in 1907.

III.—COMMENCING OUTBREAK AT A CLIFTON HOME FOR GIRLS.

Another suggestive fact has been communicated to me by Dr. George Parker. On March 4th, 1905, Mrs. H. was taken on as cook at a children’s home in Clifton, where there are thirty girls. Nothing happened until May 8th, when one of the girls duly developed typhoid fever, for which no reasonable cause could be found. Mrs. H. left at the end of April; no further cases occurred.

The recurrence of the May date as the period when infection commenced is quite remarkable, in conjunction with a similar experience in the other outbreaks associated with the same “carrier.”

The Mechanism of Infection.—There is apparently little doubt that the transference of infection by carrier cases may be defined as “gross” and that definite, though minute, amounts of infective material are conveyed into the food or milk by the hand of the carrier

through carelessness and neglect to wash the hands after attending to the calls of Nature. Mittman has described in Virchow’s *Archiv* [13] the finding of various micro-organisms, including bacilli, under the finger nails of schoolboys, waitresses, cooks, and others, and the subject hardly needs elaboration, though it suggests uncomfortable thoughts anent “our daily bread.” It is significant that, although the proportion of convalescents from typhoid fever who become carriers is quite substantial (Klinger gives 1·7 per cent. and Lentz 4 per cent., while Savage [15] considers these figures too low), few, except those engaged in food preparation, achieve distinction; and that the two known outbreaks in the neighbourhood of Bristol were actually due, not to two distinct persons, but to the same cook-carrier. A. and J. C. G. Ledingham, however, found [12] that carriers not specially engaged in food work were occasionally effective.

Prophylaxis may obviously be directed to at least three points: (1) Revised criteria for determining recovery after typhoid fever and the adoption of a prescribed routine for registration of, and bacteriological control over, all convalescents; (2) meanwhile, self-defence indicates the necessity for greater care in selecting kitchen and dairy workers for home or institution. As in the eighteenth century servants were in request who had passed through the small-pox, so in the twentieth century the competence of a cook may justly include her incompetence as a “carrier”; (3) the urgency for stringent care as to hand cleanliness before commencing or resuming food preparation or dairy work is too obvious to need insistence; hand-washing drill should become a routine part of institution discipline.

Cure.—Unfortunately, the various drugs and intestinal antiseptics hitherto used have met with pronounced failure. Dehler (1907) has actually performed cholecystostomy and drainage of the gall bladder, which seems to be followed by gradual disappearance of the bacilli, and possible cure; but, as Ledingham pertinently observes, this treatment cannot be expected to become popular. Horton Smith suggested in 1900 (op. cit.) that typhoid bacilli in small numbers may be rapidly destroyed as soon as they come in contact with the other micro-organisms in the alimentary canal, for the toxins of not a few of them are extremely inimical towards the typhoid bacillus. Can bacterial methods be looked to for a solution

of the problem? Meanwhile, what is the legal status of a "carrier" capable of distributing disease and death? Are such persons

"suffering" from a dangerous infectious disorder, and can they be placed under any statutory restrictions?

TABLE I.—SHOWING TOTAL INMATES AND STAFF, ALSO ATTACKS AND DEATHS, BRENTRY, 1906-7.

		No.	Attacked.	Percentage.	Died.
A.—Inmates ...	Total Inmates, 240 ... { F. M.	105	11	10.4	—
		135	5	3.7	1
B.—Officers, including indoor attendants, police constables, and workmen engaged permanently or temporarily during the year ...	Resident, on full board ... { F. M.	15	3	20.0	—
		9	2	22.2	—
	Non-resident, partial board (tea-milk) M.	19	3	15.6	1
	Resident off premises, no food ... M.	9	—	—	—
	Resident off premises (workman), milk on one occasion only, September 28th, 1907, sickened October 14th, 1907 (denies drinking milk) ... M.	—	1	—	—
		292	25	8.5	2
C.—Others...	Visitor (tea and cream) on one occasion only, tea party of July 31st, 1907, sickened August 20th, 1907 ... F. Gardener's wife, lives at lodge, receives milk from Institution ... F. Police constable's wife, non-resident, probably contracted from husband F.	—	1	—	—
		—	1	—	—
		—	1	—	—
		—	3	—	—

To these may be added the doctor's little boy, who developed suspicious symptoms consonant with mild typhoid on June 20th (Widal negative).

The incidence is heaviest on the male and female officers on full board (including extra milk) and next on the non-resident male officers receiving tea-milk. The incidence on the female inmates was restricted to those who helped in food preparation or received extra milk, and on the male inmates to those who helped in food preparation (messroom attendants, having access to milk).

TABLE II.—LIST OF CASES OF TYPHOID FEVER AT BRENTRY.

Case.	Approximate date of sickening.	Sex.	Description of Patient.	How Employed.	Source of Infection.
City	1906				
	1 N.B. Sept. 16	F.	Inmate	Kitchen	Extra (1 pint) milk for nursing
	2 A.H. Nov. 11	F.	Officer "	—	No food but milk.
	3 P.C.P. " 11	M.	Officer (cottage)	Lives out	Lives in Lodge, receives milk
	4 Mrs. E. " 11	F.	Gardener's wife	—	
	1907				
	5 Mrs. P. Jan. 9	F.	Wife of No. 3	Lives out	Probably contracted from nursing husband
	6 A. St. May 4	F.	Inmate	Tea house	Messroom maid
	7 S. Sp. } July 4	F.	"	—	Extra (1 pint) milk for nursing
	8 S. Sp. } " 4	M.	Baby	—	
	9 A.A. " 11	M.	Inmate	Wing	Messroom attendant ¹
	10 A.R. " 13	F.	"	Kitchen	

TABLE II.—LIST OF CASES OF TYPHOID FEVER AT BRENTRY.—(continued).

Case.	Approximate date of sickening.	Sex.	Description of Patient.	How Employed.	Source of Infection.
11 E.L.	July 20	F.	Inmate	Tea house	Messroom maid; milk stands here from 2 p.m. to 4 p.m.
12 G.G.	" 26	F.	"	Pantry	Attendant on officers; dining-room maid ¹
13 Miss H.	Aug. 8	F.	Officer	Kitchen	On full board
14 N.V.B.	" 8	M.	Carpenter	—	Gets board (officers' rations) ²
15 M.J.	" 10	F.	Inmate	Laundry	Extra (1 pint) milk for nursing
D. 16 R.G.M.	" 13	M.	Officer	Lives out	Receives no food but milk; died
17 C.W.	" 20	M.	Inmate	—	Messroom attendant followed No. 9 in his duties
D. 18 H.R.	" 20	M.	"	—	Ditto, ditto; died
City 19 Miss C.	" 20	F.	Matron	—	Infected at tea-party, July 31st
" 20 Miss F.	" 20	F.	Visitor	—	Ditto
" 21 H.P.	" 27	F.	Inmate	Tea house	Messroom maid, followed No. 11 in duty here; milk stands here from 2 p.m. to 4 p.m.
22 W.W.	Sept. 19	M.	"	—	Attendant ¹
" 23 E.C.	Oct. 14	M.	Stoker	Lives out	Only had one meal in institution, September 28th, 1907 (denies drinking milk supplied)
" 24 L.P.	" 31	M.	Engineer	"	Has milk occasionally to use for tea
25 A.W.	Nov. 7	F.	Inmate	Pantry	Attendant on officers; dining-room maid
26 S.B.	" 9	M.	Officer	—	Indoor officer, full board
27 Miss P.	" 13	F.	"	—	Ditto
28 A.S.	" 24	F.	Inmate	Kitchen and Scullery	

¹ Inmate attendants clear tables after food and have special access to food and milk.

² Inmates receive an allowance of a quarter of a pint of milk daily, which is put directly into boiling tea in a large can; only inmate attendants have access to milk. Officers receive half a pint, part of which is used cold for porridge.

Total, 28 inmates ... { M. 5 } 16   Officers ... { M. 6 } 9
(including baby) ... { F. 11 }

Also two officers' wives, one visitor, and (?) the doctor's little boy.

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