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**Dr. Ballard's Report to the Local Government Board upon
an Epidemic Outbreak of Enteric Fever in the Village
of Millbrook, in the Rural Sanitary District of St.
German's, Cornwall.**

GEORGE BUCHANAN,
Medical Department,
December 7, 1880.

The village of Millbrook is situated at the head of a creek or branch of the Hamoaze, known as Millbrook Lake. At low water the whole extent of the creek, except a very narrow channel, is nothing but mud banks. Where houses adjoin it and drain into the lake, these banks are very often offensive. A branch of the creek, of the nature of a tidal brook, about a yard and a half wide, runs up through a part of the village and forms a common open sewer, into which houses along its banks drain, and into which the privies connected with them discharge themselves. This brook is in a very filthy condition habitually, the Sanitary Authority and the Highways Authority not having agreed as to whose business it is to keep it in good order.

The village, consisting of several streets of houses, almost all of the cottage class, and occupied by artizans, small tradespeople, and pensioners and their families, lies partly at the level of the creek, and partly on ground rising, sometimes steeply, from that level. Beneath the surface earth there is a loose slaty rock for a varying depth, and below it a firmer rock of the same character, through the fissures of which water can percolate.

Prior to last year the only drainage the village possessed consisted of square flat-bottomed superficial drains in the highways, constructed of slabs of stone set up edgeways at the sides of flat-bottomed trenches, and covered at the top with similar slabs. They were constructed ostensibly for the drainage of the highways, but domestic slop waters were discharged into them also, and, in some instances, waterclosets had been connected with them too. The final discharge of these drains was into the lake at the head of the creek and along its edge. Privies were almost invariably of the old-fashioned cesspit type—mere holes dug into the earth or loose rock beneath. A loan of 1,000*l.* having been sanctioned and obtained for the purpose, sewerage works were commenced in September 1879, and completed in March 1880, and now pipe sewers have been laid down in the principal streets. But about one-third of the village is still unsewered. In such parts the old square drains are still in use as before. It is said that where pipes have been put in, the square drains have been broken up. In some parts the old square drains have been made to communicate with the new sewers. It is said that generally where new sewers have been provided, private premises have been connected with them. Notices thus to connect were served by the Authority upon the owners of all houses in the course of the new sewers, and many at once complied; but there was no one appointed by the Authority to see that the house drains were properly laid or the connexions duly or safely made, so that on all hands there is entire ignorance on this important subject. In some instances (the Inspector of Nuisances, Mr. Johns, who acted also as the surveyor of the Authority in this matter, says in about one half the houses in the line of the sewers), the cesspit privies have been emptied and filled in with rubble, and waterclosets substituted. I certainly saw a good many premises in the line of the sewers where cesspit privies still existed, and where they were in an offensive condition; the only connexion of private premises with the sewer in those cases being by means of a drain having its inlet, sometimes trapped and sometimes untrapped, in the back yard or within the dwelling itself. Where there was a trap it was usually the ordinary inefficient bell-trap. Sometimes I heard complaints of stinks proceeding from inlets within houses.

The outfall of the new sewers is an 18-inch iron pipe which discharges into the bed of the lake about half a mile below the village. The opening here, which is exposed at low water, is protected by a flap-trap. No efficient means of ventilating the sewers have been provided. Five 4½-inch iron pipes rising from them at long intervals to above the eaves of houses cannot be regarded as affording proper or efficient ventilation. The street gullies connected with the sewers have all been well trapped, and hence the sewer air forced up at each tide from the outfall sewer, and displaced whenever any matters enter the sewer, can only escape by leakages in the pipes and house drains, or by the inlets (loosely trapped, when trapped at all), about private premises. Those drains, except in the case of a few better class houses, and watercloset soil pipes, are unventilated. A flushing tank has been provided at the extremity of one of the sewers, but no proper arrangements have been made for flushing the sewers generally.

One or two of the houses are supplied by pipe and tap from a private reservoir of water (established for the use of the South Down Copper Works) on a hill near the village; but this water is declared by the manager of the works to be polluted near its source. Otherwise and generally the water supply for all purposes throughout the village consists of wells sunk at varying depths, but mostly only a few feet, into the rock on which the village stands. Of these wells, five are public, one being covered and provided with a pump, one being enclosed by a door and having a pipe with spout and tap for the delivery of the water, and the other three being open. In addition to these there are numerous private wells, some open, and some covered and provided with pumps. All these wells, with perhaps the single exception of the spouted well at Millpool Head* are obviously liable to pollution, and at times dangerous pollution. During the dry weather of the summer many of them, both public and private wells, were very low or even altogether dry. It is obvious that their supplies of water are merely derived by percolation from the filth-polluted or sewage-polluted earth, and loose or fissured underlying rock in their immediate vicinity. Of the open public wells or open shallow tanks which pass under that name, two contained turbid water at the time of my visit, and no water was obtainable from the pump well. One of the private wells I examined had an overflow pipe communicating directly with an old drain (which at that very time was specifically infected); and recently the Medical Officer of Health had discovered another well similarly connected with the sewer, and had caused the connexion to be broken. It is not unlikely that other wells are similarly provided with means of conveying sewer air into them. Some of the wells at the lowest level of the village, near the quay, are further liable at high spring tides to pollution from the flood water from the creek or "lake" percolating into them. The specially dangerous nature of this percolation may be gathered from the fact that the percolating water partly flows up through the drains and that a large number of privies and drains are discharged into the "lake" close by. Yet these wells are used for drinking purposes by many families.

Looking then at the conditions described, both of drainage and water supply, ample provision existed for the spread of such diseases as habitually spread through communities by the agency of infected sewer air and infected drinking water, of which diseases enteric fever may be regarded as a type. Notwithstanding the works of sewerage which have been done, this provision is maintained as fully as formerly: indeed it is only proper to say, that by the neglect of due means of preventing the access of sewer air to private premises, additional provision has been made by the new sewers for the spread of such diseases among the population. The efficiency of sewerage for the prevention of such diseases depends upon the adoption of a variety of details and precautions which have been overlooked by the Authority in the sewerage of this village.

I am informed by Mr. Worth, the Medical Officer of Health, that so long as he has known the village (and his predecessor in his practice there told

* Since my inspection, Dr. Cheeves of Millpool has informed me that even this is a suspicious water, since he has known it to become offensive after standing 24 hours in a water bottle in a bed-room.

him that this had been his experience also), enteric fever has been endemic in it, never a year having passed without the appearance of the disease in some of the families. It was clearly his duty then, as soon as practicable after his appointment, to thoroughly investigate the causes of this endemicity, and to represent to the Authority the nature of those causes and the remedies which it was necessary to apply, in such a manner as to leave them no excuse of inaction or imperfect action, and thus the Board would have been kept fully informed of the state of affairs in the district under his care. No information upon the subject, however, has been capable of being gathered from his annual reports forwarded to the Board; nor is it practicable to collect from them any evidence of action on his part in the direction of advice tendered to the Authority on the subject, beyond a recommendation for the drainage of the village. Last year enteric fever was endemic as usual: I have a list of eight cases, three of which were fatal. But in the present year an epidemic burst of this disease has occurred, and the disease has spread among the inhabitants in such a manner as to involve almost the entire village. The epidemic commenced in January, but its occurrence was not communicated to the Board until September 21, after a letter from the Registrar of Births and Deaths had brought the fact of the epidemic under the Board's cognizance, and an application had been made to the Authority for a report from the Medical Officer of Health upon the subject. This report, when received, was of so unsatisfactory a character, that the present inquiry was directed to be made.

The last case in the list of cases of enteric fever which occurred in 1879 was that of a lady who came first under medical treatment on September 3. She had a very severe and protracted illness and medical attendance was not discontinued until January 14 this year. She had contracted the disease at Stoke, near Devonport, but passed through her illness in one of a pair of semi-detached villa residences at Anderton, in the outskirts of the village of Millbrook. On January 2, this year, another lady in the same house was attacked, and on January 12, a housemaid in the same house was attacked.

On January 20, a case occurred in the adjoining villa which was at that time drained into an unventilated cesspool common to the two houses. The housemaid above mentioned, when she was taken ill, went home to Newport Street in Millbrook village and passed through her illness there. Newport Street is one of the streets which have been sewered. Up to the end of May (so far as the list of cases furnished to me by the Medical Officer of Health shows) only three additional families were attacked, eight cases having been observed during this period. But in June a rapid extension of the disease took place. In June the invasion of 6 fresh families and 16 cases are recorded; in July the invasion of 8 fresh families and 17 fresh cases; in August 11 fresh families and 19 fresh cases; in September 12 fresh families and 23 fresh cases. Since September and up to the commencement of my inquiry on October 18, I have had given me a record of 4 fresh families invaded and of 8 new cases. Probably there have been many more cases than have been recorded. Altogether out of about 250 houses of which the village consists, at least 47 have been invaded by the fever, and at least 91 cases have occurred in a population of (at the highest computation) about 1,500. Of these cases three have died of the disease. Of these 91 cases 14 were under medical treatment on the 18th of October.

The progress of the disease then was unchecked at the time of my visit on October 18: obviously no pains had been taken to trace out the causes of its epidemic prevalence, nor had active measures been taken to arrest its extension. A parochial committee (appointed annually) had indeed, it is said, frequently met to consider the subject; and had been in communication with the Medical Officer of Health; but the minutes of the Committee (which are from time to time submitted to the Sanitary Authority for confirmation) contain nowhere any reference to the epidemic: hence, neither through the Medical Officer of Health nor through the parochial committee had the Authority received any official intimation of the existence or progress of the epidemic. It must be added however that the Authority was not altogether without information on this subject, inasmuch as the Inspector of Nuisances, having several times visited the village at the desire of the Medical Officer of Health, just briefly mentioned in his report on July 1 the existence of

"several cases of low fever" there. The Medical Officer of Health excused himself to me for his neglect of giving information of the outbreak on two grounds: one was that he was in communication with the parochial committee habitually and considered that this was sufficient; and the second that the Committee was desirous, in the interests of the inhabitants who let lodgings to visitors in the summer season, that the fact of the epidemic should not be made public. At a meeting of the Authority which I attended the chairman of the parochial committee excused the Medical Officer of Health on this very ground. I quote from the report of the meeting as given in the "Western Morning News" of Oct. 22. "Mr. Boyle said he must exonerate Mr. Worth a little about reporting to the Board. They had a meeting at Millbrook of the Local Sanitary Committee to discuss the whole of these matters, and there was a very strong feeling that this should not be promulgated much, because of the injury it would do the village. The Chairman: In other words it would keep away the lodgers (laughter)." All that was done by either the parochial committee or the Medical Officer of Health appears to have been this, viz.: some disinfectants (chiefly Condy's fluid) were supplied at the cost of the Authority to infected families for admixture with the discharges and to set saucers about the rooms of the sick; verbal directions were given generally to bury the evacuations in the earth instead of throwing them into the privies, and in three instances obviously polluted wells were dealt with. One of them was a well supplying several infected families, which well I have already mentioned as at that time being in communication with an infected sewer; and the two others were obviously sewage polluted wells the water of which the householders were advised not to use for drinking purposes. This was the full extent of the action taken. It was left for me, at a late period of the epidemic, to do the work which should have been done at a much earlier period by the Medical Officer of Health, namely, to trace out the causes of the epidemic prevalence of the disease and to advise the Authority upon the subject.

It is impossible to say whether of the first eight cases in the list of this year, the five which did not originate at Anderton but in the populous part of Millbrook were all referable to the contagium newly introduced into the village by the housemaid from Anderton or whether one or perhaps two might not have originated in the village from contagium left in it by cases further back: but it is certain that a brother of the housemaid residing in the same house with her in Newport Street was the first person attacked after her, and subsequently, viz., in April, that a fresh family residing a few doors off in Newport street was invaded. No doubt the sewer of Newport street became infected about this time, and only opportunity was wanting for the introduction of the contagium from that sewer into other families residing in houses along its course and along the course of the other sewers with which it communicated. Unfortunately, this opportunity was found about the middle of May in the connexion of the overflow pipe from a well in Fore Street with the public sewer. This was a private pump well, which supplied with drinking water several houses and families in the neighbourhood. Into the closed space above the water of this well infected sewer air must necessarily have penetrated, infecting the water with the contagium of the disease. Out of seven families invaded next after the family last mentioned, the first was a family using this well, and then four other families also using it were invaded—that is to say, five out of the seven families. In these five families there occurred altogether 13 cases. At a later period of the epidemic another family using the well was invaded, and four more individuals who drank the water were attacked. About this time—namely, about the middle of June or beginning of July (perhaps earlier)—another unfortunate coincidence led to the invasion of fresh families, and to an incalculably wide distribution of the contagium. In the rear of the house first invaded in consequence of drinking this well water is a group of water-closets (not supplied with water) from which a pipe drain carried the infected discharges and the washing slops from a drain in the yard into an old square drain, which finally discharged itself into the lake, in an unsewered part of the town. There is a new sewer in Fore Street, however, with which, when it was laid down, these closets and drain might have been connected; but

apparently the old drainage was regarded as sufficient for the purpose. Into this same old square drain above mentioned a pipe drain had also been carried from a slaughter-house, part of which slaughter-house was boarded off to constitute a dairy, on shelves of which milk was habitually set in pans, which milk was sold to inhabitants of the place. The slaughter-house was not used for slaughtering, but was habitually used as a washhouse. An adjoining watercloset for the butcher's family communicated with the drain, as also did other drains about the premises. In one corner of the slaughter-house nearest to the dairy was an untrapped or inefficiently trapped drain inlet, which had for a very long time been a source of annoyance from the offensive smells issuing from it habitually. The premises are infested also with rats. Close to this drain inlet runs the wooden partition between the slaughter-house and the dairy, and a part of the partition near the inlet had evidently been long broken away or gnawed away by rats, so that the infected sewer air which issued from the inlet had free access to the dairy also, and to the milk which stood in it. Now, it is worthy of observation that the very next family invaded after the group of families whose invasion I have attributed to the infected well water just referred to, was that of the butcher to whose house this slaughter-house was attached, and to whom the dairy also belonged. Six cases of fever occurred in this man's family, the first coming under medical treatment on July 2, and the last on July 20, and at no time during the whole epidemic, not even during the period of at least six weeks that the infection existed in his family, was the sale of milk suspended for a single day. The butcher himself did not appear to be aware of the danger attending the sale of milk under these circumstances, and readily gave me a list of eight families in different parts of the village whom he habitually supplied—regular customers. One of these families, however, was away from the village at the time of the epidemic, and was therefore not supplied by him, but of the remaining seven, six have been invaded with the fever, and only one has altogether escaped. In the six families, 13 cases have occurred, which, with the six in the butcher's own family, make 19 cases which may have become infected by drinking the infected milk. But besides these regular customers he has had occasional purchasers of whom no accurate account can of course be given, but at least three families invaded in August and September the butcher knows to have been occasional customers. It is indeed quite impossible to say to what extent the disease may have been spread in this way. Nor is it practicable to point out precisely how, from the various families infected by the use of the infected well water and infected milk, the contagium has spread to other families. It is sufficient to say that ample facilities for the spread of the disease from family to family through the village were afforded by the general condition of the drainage arrangements and of the water supply, until the whole village has become steeped in the contagium.

The dwellings in the village and the yards attached to them cannot be said to be uncleanly; the Inspector of Nuisances, judging from what I saw, and from the reports in his book appears in this respect to have performed his duty.

The Union of St. German's is one of those in which the Poor Law Medical Officers have been also made, each in his own district, Medical Officers of Health. Not having been instructed to inquire generally into the success of this arrangement in other parts of the Union, I can only say that, in the Millbrook district, the arrangement has issued in the object and spirit of the Public Health Act having been lost sight of under the shadow of a technical compliance with the law, which compels the appointment of a Medical Officer of Health, and permits of the delegation of matters of peculiarly local importance to a parochial committee. Mr. Worth, the Medical Officer of Health, receives a salary of 4*l.* 10*s.* per annum (no part of which is repaid out of moneys voted by Parliament), and has a considerable and onerous private practice; so that he has little time at his disposal for sanitary work, and but little pecuniary inducement to give much attention to it. Nevertheless both he and the Inspector of Nuisances devoted to my assistance nearly the whole of each of the days occupied by my inquiry.

On October 31, that is to say, immediately on the termination of my inquiry, I attended a meeting of the Sanitary Authority, and after explaining generally my views respecting the habitual endemicity and now the epidemic spread of enteric fever in Millbrook, I advised them as to the measures which they might at once adopt to check its progress. These were: 1. The thorough disinfection, by the use of disinfectants of the kind and in the manner which I explained in detail, of all privies, waterclosets, house drains, and sewers in the village, and the gratuitous supply of efficient disinfectants to infected families, with directions as to the mode of using them by admixture with the evacuations of the sick, and in the disinfection of soiled articles of bedding or clothing. 2. The immediate provision of ventilation for their sewers, by the untrapping of the street gullies, or by opening of the man-holes of the sewers, especially of the outfall sewers. 3. The issue of printed notices, informing the inhabitants of the dangerous qualities of the well waters generally, and the supply of water from Millpool Head or some other wholesome source by means of water-carts, to such parts of the village as are inconveniently distant from Millpool Head, until such time as a wholesome permanent supply of water shall be provided for the whole village. 4. That steps should be taken to cause the discontinuance of the sale of milk from the infected dairy, and for putting the premises of the dairy into a wholesome condition. If the aid of the Inspector appointed under the Order of the Privy Council is requisite to obtain these results, the Sanitary Authority will do well to request his interference. I left with the Authority a brief memorandum embodying this advice.

October 23, 1880.

EDWARD BALLARD.

Recommendations.

In addition to the advice tendered to the Authority, as stated in the report, the following recommendations are made, their object being not merely the arrest of the existing epidemic, but the prevention of a similar occurrence in the future, and also generally the improvement of the sanitary condition of the village:—

1. The sewerage of Millbrook should be extended so as to embrace all parts not yet sewerage, and all premises should be duly connected with the sewers, so as to cut off all discharge of sewage into the "lake" in and near the village.
2. Free ventilation for all the sewers should be provided at distances not less apart than 50 yards. Each man-hole may be made a ventilating opening, and where the distances between the man-holes much exceeds 50 yards, intermediate ventilating openings should be made.
3. Arrangements should be made for the due flushing of all the sewers, and they should be flushed properly and periodically. Each man-hole may be made a flushing chamber.
4. The bed of the "lake," where it passes unculverted through the village, should be provided with a proper paved invert and kept clean by the Authority.
5. All house drains should be duly ventilated, and care should be taken that all drain inlets in and close to dwellings are trapped with some reliable trap, the ordinary bell trap being an inefficient trap.
6. A water supply for the village generally should be provided from some wholesome source at a sufficient distance from the place, and should be given by pipe and tap on the "constant" system. The public wells should be then closed, public supplies from the new sources being given in their stead. Private wells, the water of which may be represented to the Authority by their Medical Officer of Health or any other person, to be polluted so as to be injurious to health, should be actively dealt with by the Authority under section 70 of the Public Health Act.

[In carrying out the above recommendations, the Authority may usefully take as their guide Mr. Rawlinson's "Suggestions as to Main Sewering and Drainage and as to Water Supply."]

7. Foul and offensive privies should be dealt with in such a manner as not only to cause the abatement of existing nuisance, but so as to prevent the recurrence of nuisance.
 8. In future the Sanitary Authority should see that their Medical Officer of Health strictly carries out the instructions and directions pertaining to his office which are contained in the Board's Order of March 12, 1880, relating to the duties of a Medical Officer of Health.
 9. The Sanitary Authority should at once make, under section 131 of the Public Health Act, proper provision for the isolation of persons sick with infectious diseases, by the adoption of one of the arrangements specified in that section. And in respect of the isolation of the sick, and in respect generally of the arrest of infectious disease, they should actively use the powers vested in them by sections 120 to 129 of the above Act.
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