

THE INFLUENCE OF PRIVY-MIDDENS AND WATER-CLOSETS IN DIARRHŒA AND TYPHOID.*

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FOR many years sanitarians have directed attention to the evils of the privy-midden system, and condemned it as the most abominable of closet systems. The ground around and under the dwelling houses becomes soaked with liquid filth, and the atmosphere becomes contaminated with the ground air saturated with the sewage vapour. The ashpits are emptied into the back passages and streets, with the result that in dry weather some of it is carried as dust by the wind into the houses, and settles upon the food and drink. It is also carried into houses on boots and shoes, and deposited on the floor coverings. The children play about on the floor, and continually put their fingers into their mouths, on which may be some of the dirt brought in from the streets. When diphtheria or other infectious disease shows itself, the parents wonder how it has originated. During hot weather the stench which arises from the middens where the houses are packed closely together, is indescribable. With such a system, it is perfect truth to say that the people live on the top of, and eat, drink, and breathe their own excrement.

Dr. Sergeant, County Medical Officer of Health for Lancashire, in his report for 1903, states: "Privy-middens are now generally regarded by Local Authorities as a prolific source of disease, and it is satisfactory to observe that increasing energy has been directed by sanitary officials towards the removal of this nuisance; and the provision of a system more in accordance with modern requirements. Unpaved backyards and house surroundings are referred to as sodden with fæcal matter, and held responsible for many occurrences of endemic disease."

More and more each year the privy-midden has become associated with the annual epidemics of typhoid and diarrhœa in an increasing number of reports of Medical Officers of Health. Dr. Niven, in 1898, says, "A study of the manner in which typhoid repeats itself in the midden districts shows there is a strong tendency for it to persist from year to year, or perhaps with the intermission of a year. Nothing could well be clearer than this demonstration of the influence of

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privy-middens in causing the disease, and we may infer of others owning a like origin. There can be no doubt that the bacillus of typhoid fever persists especially in the neighbourhood of middens, grows near and on the surface rapidly under favourable conditions, and that in some way it causes the disease."

During an attack of typhoid fever the germs of infection are given off in the evacuations, and find their way into the ashpits, and remain there a source of infection, as shown by the investigation undertaken by Prof. Delepine at the request of Dr. Crocker (Eccles). Under favourable conditions these germs may multiply exceedingly outside the body, and become a distinct danger to the inhabitants of privy-midden districts.

Dr. Robertson (Sheffield) made some valuable experiments whilst Medical Officer of Health for St. Helens, showing that typhoid germs when sown artificially into clean soil (uncontaminated with filth), in the course of the winter months, do not retain their vitality, but die out, starved; also that when similar sowings are made into earth soaked with animal filth, the germs can live through the winter, and are able the next year, when the earth temperature rises high enough, to multiply and replenish the earth with death-dealing microbes, so that probably an area once infected remains infected from year to year, as long as the soil is kept soaked with filth, and especially the filth of human excrement.

In the subjoined table are given typhoid notifications and deaths from diarrhoea for the past four years in the Gorton district, occurring in houses with privy-middens, and with water-closets.

| | Popula- tion. | No. of Privies. | No. of Water Closets. | Typhoid Notifications. | | | | Diarrhoea Deaths. | | | |
|------|------------------|--------------------|-----------------------------|------------------------|-------------------------|-------------------|----------------------------|---------------------|----------------------------|-------------------|-------------------------|
| | | | | No. of Cases in | | Rate per 1,000 | | | | Rate per 1,000 | |
| | | | | Privy Houses. | Water Closet Houses. | Privy Houses. | Water Closet Houses. | In Privy Houses. | In Water Closet Houses. | Privy Houses. | Water Closet Houses. |
| 1901 | 27,000 | 4,050 | 1,350 | 84 | 5 | 19·5 | 3·7 | 86 | 3 | 21·2 | 2·2 |
| 1902 | 27,500 | 4,000 | 1,800 | 29 | 4 | 7·2 | 2·2 | 26 | 6 | 6·5 | 3·3 |
| 1903 | 28,500 | 4,000 | 2,200 | 31 | 5 | 7·7 | 2·2 | 44 | 4 | 11·0 | 1·8 |
| 1904 | 30,000 | 3,900 | 2,500 | 23 | 4 | 5·8 | 1·6 | 34 | 9 | 8·7 | 3·6 |

AVERAGE OF 4 YEARS.

| | | Rate per 1,000 | |
|-----------------|-----|----------------|----------------------|
| | | Privy Houses. | Water Closet Houses. |
| Typhoid Cases | 185 | 10.0 | 2.4 |
| Diarrhœa Deaths | 212 | 11.8 | 2.7 |

The difference in favour of water-closets is even very much greater than indicated by the figures, due to the fact that many of the water-closet houses are back to back and surrounded by privy-midden houses, and some hundreds of the water-closet houses are very close to night-soil tips. Of the diarrhœa deaths, 91 per cent occurred in the months of June to October, and the remainder in May and November, and a few in December.

With typhoid notifications I have taken the figures for the Manchester area for 13 years, 1891 to 1903. For the first quarter of the year there were 1413, second quarter 1087, third quarter 1724, fourth quarter 2260. Taking the figures for half-year periods they are, January to June 2500 cases, and July to December 3984. The percentage is 38.5 for the first half of the year, and 61.5 for the second half of the year.

The figures relating to diarrhœa give every indication that there is a cause operating during the warm months of the years, and which is absent during the colder parts. Since 1898 I have endeavoured to show year by year, in my annual reports, the connection between this disease and the domestic fly. A hot, dry summer produces an abundance of flies, and diarrhœa makes its appearance in about a week after the flies appear in large numbers. The diarrhœa sickness fluctuates and keeps pace with the temperature of the atmosphere, which is much influenced by the rain-fall, also the number of flies keep pace with the temperature of the atmosphere and the rain-fall. It is rare for the epidemic to begin before July; if it does, there will be found to have been several weeks of very hot weather in the early part of June, accompanied by large numbers of flies. Also it is rare for it to continue beyond October 15, and if so, it will be noticed that the warm weather continued into the autumn longer than usual.

The atmospheric changes are but secondary causes in the production of the disease, namely, as influencing the appearance and disappearance of the common house-fly, and also as affecting their numbers. The principal factors in the production of the disease are two, namely, privy-middens and flies, the latter conveying the germs from the privy-middens on to food, which is almost exclusively cows' milk.

During the summer a privy-midden was examined at the house of a typhoid case; the flies were hanging in bunches and wading in and sucking up the liquid excreta, flying directly into the kitchen, into milk vessels, and on to food exposed on the table.

The earth temperature of 56° four feet below the surface, —upon which so much stress was laid years ago—has no connection with, or any bearing upon, the annual epidemic of diarrhoea; that temperature may be reached and sustained, or exceeded, for weeks together, and no epidemic of diarrhoea appears, if the atmospheric temperature is low for the months of July, August, and September, or if there be much rain during the period—limiting the number of flies. A very great difference is observed in the number of flies in those rows of houses supplied with water-closets and dry ashbins, as compared with privy-midden houses.

The infantile mortality is greatly influenced by the annual epidemic of diarrhoea, and there is little chance of permanently lowering that mortality in a privy-midden district until they are abolished and water-closets substituted.

The figures relating to typhoid are not so definite and conclusive as with diarrhoea, but they are sufficiently striking to indicate that there is an additional cause in force during the warm months of the year.

In the case of diarrhoea, observation since 1898 shows that diarrhoea makes its appearance in a week or ten days after flies appear in large numbers, but in the case of typhoid, three or four weeks elapse before an increase of notification certificates is observed; and the same thing happens at the end of summer. Diarrhoea deaths lessen from ten days to a fortnight after the flies disappear in October or early in November, but the typhoid notifications do not abate for nearly a month after that, and gradually lessen into December. The Manchester figures give 61 per cent of the cases from July to December, and the county of Lancaster 70 per cent of the cases from June to December for 1093 out of 1434 notifications.

Dr. Howard Tooth, in an address before the Clinical Society of London on March 8, 1901, on "The recent epidemic of Typhoid Fever in South Africa, and agencies concerned in the dissemination of the disease," states:—

"As may be expected, the conditions of these large camps were particularly favourable to the growth and multiplication of flies, which soon became terrible pests. I was told by a resident at Bloemfontein that these insects were by no means a serious plague in ordinary times, but that they came with the army. It would be more correct to say that the normal number of flies was increased owing to the

large quantities of refuse, dead horses, etc., upon which they could feed and multiply. They naturally infest persons who are ill, but seem to be peculiarly attracted to enteric patients, hanging in loathsome groups around their mouths and feeding vessels. They were all over our food, and the roofs of our tents were at times black with them.

"It is a well-known fact that with the appearance of the frost, enteric fever rapidly disappears. The winter in South Africa is very mild compared with what we are accustomed to in England. It is true that the nights are cold, sometimes to many degrees of frost, but the days are warm and bright; for instance, in my tent at mid-day the temperature was rarely below 70° F., and sometimes as high as 80°. It seems hardly credible that the almost sudden cessation of an epidemic can be due to the effect of cold upon the enteric bacilli only. But there can be no doubt in the mind of anybody who has been living on the open veldt, as we have for three or four months, that the flies are extremely sensitive to the change of temperature, and that the cold nights kill them off rapidly. On consideration of these points it is surely justifiable to assign an important share to flies in the spreading of infection."

In an article on the same subject by A. B. Dunne, M.B., B.C. (late Civil Surgeon, South African Field Force), he states:—

"Nothing was more noticeable than the fall in the admissions from enteric fever, coincident with the killing off of the flies on the advent of the cold nights in May and June."

At a meeting of the British Medical Association, held in Manchester, 1902, a paper was read on the investigations of Major R. H. Firth, and Major W. H. Horrocks, Army Medical School, Netley, on "An inquiry into the influence of soil, fabrics, and flies, in the dissemination of enteric infection":—

"Experiment 36 was directed to determine, if possible, on what parts of the fly's body the enteric infective matter attached itself. Preceding results had established the belief that the 'blows,' or excretal deposits, were free from enteric bacilli. A certain number of flies (all common house flies) which had been in contact with the exposed infective material were caught and killed. By means of sterile forceps their heads, wings, legs, and bodies were separated and respectively placed in sterile broth. From the resulting broth growths, litmus glucose agar plates were set. From each series of plates the enteric bacillus was recovered.

"Ordinary house-flies (*Musca domestica*) can convey enteric infective matter from specific excreta or other polluted material, to objects on which they may walk, rest, or feed. That such infective matter appears to be attached not only to their heads, but also to their legs,

wings, and bodies. It has not been proved that the enteric bacillus passes through the digestive tract of the fly."

That there are other causes in the dissemination of the typhoid germ in addition to the fly is evident from the fact that 30 to 40 per cent of the cases occur at a season of the year when the common house-fly is absent. Many such cases are traced to contaminated milk, infected water supply, shell-fish, and watercress. Lately it has been found that early broccoli imported from Italy have given rise to cases, due to forcing them for the English market with the contents of cess-pools. A similar state of things is carried on in many market gardens in Cheshire, as I have actual proofs. Midden refuse is put on to the ground and growing vegetables, and the contents of privies are ladled into tubs, diluted with water, and the vegetables watered with such to force their growth, and then brought into the Manchester market.

I have endeavoured, very briefly, to show the close connection between the diseases, summer diarrhœa and typhoid fever, and the different methods of domestic sewage disposal, and that the balance of favour is altogether on the side of the water-carriage system; and further, that the infantile mortality is closely affected and influenced by the summer diarrhœa death-rate, and that it is much more important to combat every cause of an unnecessarily high death-rate than to deplore a lowering birth-rate.

DETERMINATION OF NITRITES IN WATERS.*

By W. P. MASON.

It may be worth while to call attention to the fact that the "nitrite" error, due to the presence of burning Bunsen lamps, is often much greater than is suspected. In the water laboratory here, the chemically pure distilled water is prepared by the use of a large copper retort, heated by a very broad Bunsen burner. Only one other lighted burner is constantly in the room, and that a small one. Distilled water, as delivered by the tin worm, was tested with the following results, duplicates being run in each instance. One Nessler tube was exposed to the room atmosphere, after addition of the nitrite reagents, and the other carefully protected therefrom. The results are stated as parts per million.

| Conditions under which distilled water was collected. | Nitrites present in protected tube. | Nitrites present in unprotected tube. |
|--|-------------------------------------|---------------------------------------|
| Not allowed to come in contact with air of laboratory ... | None | 0.0015 |
| Slight contact with air. Tin condensing tube entering neck of receiving bottle ... | 0.002 | 0.003 |
| Water allowed to drop six inches through open air to receiving casserole | 0.007 | 0.008 |

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