Original Articles.

TYPHOID FEVER IN BOSTON.¹

BY J. H. MCCOLLOM, M.D.

ALTHOUGH typhoid fever is not so prevalent in Boston as some of the other zymotic diseases, yet it is sufficiently frequent to demand a careful inquiry into the cause of its comparative prevalence. The influence of typhoid fever on the death-rate of Boston can be appreciated from a study of Chart A, which shows the number of deaths from twenty-five principal causes for the year 1892. The diseases generally classed among the zymotic are indicated by the broken line. From this comparative statement it is evident that typhoid fever is not a very potent factor in increasing the death-rate of Boston.

CHART A.

The effect of a good public water-supply in diminishing the prevalence of the disease is illustrated by the history of typhoid fever in this city for the past forty-seven years. A study of mortuary statistics shows that for the four years from 1846 to 1849 inclusive, when the water-supply was taken from wells the ratio of deaths per 10,000 of the living was 17.4; that after the introduction of Cochituate water in the latter part of 1848, the rate commenced to decline, so that in the semi-decade from 1850 to 1854 the ratio was 8.2 per 10,000 of the living. Since 1854, with a few exceptions, the rate has gradually diminished each year until it has fallen to 2.9, the rate in 1892. Another very interesting fact bearing on the subject of a public water-supply as compared with wells, is that in Charlestown, for the five years subsequent to the introduction of the Mystic water, 1866 to 1870, there was a very decided diminution in the ratio of deaths from this disease as compared with the five years previous to its introduction.

For the purpose of a study of the prevalence of typhoid fever in Boston as compared with the disease in ten American cities and six foreign cities Chart B, which shows the ratio of deaths from typhoid fever per 10,000 of the living in Boston, New York, Philadelphia, Chicago, a group of cities comprising Worcester, Lowell, Fall River, Cambridge, Lynn, Springfield and Haverhill, the aggregate population of which equals that of Boston, London, Paris, Berlin, Vienna, Glas-

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gow and Moscow for the five years from 1888 to 1892 inclusive, has been prepared. It will be seen from this chart that the ratio of deaths per 10,000 in Boston is 3.64; that in New York the rate is slightly lower, 2.30; that in Philadelphia the rate increases to 6.49; that in Chicago the rate is 8.64; and that in the group of cities the rate is 5.11. So far as the foreign cities are concerned, it will be seen that Vienna, Berlin, London and Glasgow have respectively

Range of Cities
 Worcester, Lowell, Springfield, Lynn,
 Haverhill, Fall River, Cambridge
 Population in 1892, 469,466.

CHART B.

rates of 1.19, 1.24, 1.35 and 1.72; that Paris and Moscow have each a rate of 3.16, nearly the same as that of Boston. It should be remarked, however, that, owing to the prevalence of typhus fever in Moscow, the liability of mistaking typhoid fever for this disease is much greater than in any of the other cities, and therefore the statistics in Moscow cannot be considered absolutely reliable as far as typhoid fever is concerned. It is also evident, from a study of this chart, that in the

CHART C.

American cities, those having a good water-supply have a low rate, for instance, New York and Boston; that in Philadelphia and Chicago, the water-supplies of which are certainly not above reproach, the rates are comparatively high. In the group of cities it will be seen that the rate is nearly double that of Boston. While it is true that some of the cities, included in the group, have a good water-supply, it is also true that in all of them there are a greater or less number of wells which are likely to become contaminated by the

discharges from typhoid fever patients, and thus prove active agents in spreading the disease.

In order to avoid all sources of error in regard to the population which in some instances has been estimated and in some instances enumerated, Chart C, which shows the percentage of deaths from typhoid fever to the total mortality in these several cities, has been drawn. From this chart it will be seen that the percentage of deaths from this disease to the total mortality in Boston is 1.53; that in New York the percentage is .91; that Philadelphia and Chicago have a rate of 3.13 and 4.51, respectively. In the group of seven cities before mentioned the per cent. is 2.28. In the foreign cities it is found that London has a per cent. of .68; that in Paris the rate is 1.40; that in Berlin the rate is 1.58; that in Vienna the rate is .40; that Glasgow has a per cent of .77; and that in Moscow the rate is .83.

Chart D shows the ratio of reported cases of typhoid fever to the thousand of population in Boston for three

CHART D.

years, from 1890 to 1892 inclusive, with the number of inhabitants to the acre in each ward in 1892, and the maximum and minimum elevation in feet above mean low water. The full line indicates the ratio of reported cases to the thousand of population, and the broken line the maximum and minimum elevation in feet. In Wards 1 and 2, comprising East Boston, it will be seen that the ratio is 1.18 and 2.11 respectively. There seems to be no satisfactory explanation of the difference between the ratios in these two wards. In this district the question of wells as a source of water-supply cannot be considered, as no wells were found where typhoid fever occurred. In Charlestown, comprising Wards 3, 4 and 5, there is very little difference in the ratios which range from 1.35 in Ward 3, to 1.69 in Ward 4. Situation near tide level is not an important agent in causing the prevalence of the disease in this locality, for the highest ratio was reached in the ward that has the greatest elevation, namely, Ward 4. The slight increase in the frequency of the disease in this ward is probably due to the fact that in this locality the majority of the population leave the city for a greater or less length of time during the summer months, and contract typhoid fever in the country. Mystic water as compared with Cochituate can have no great influence in causing the prevalence of the disease as the ratio of cases in

Charlestown is lower than that of most of the other wards of the city. In the city proper, comprising Wards 6, 7, 8, 9, 10, 11, 12, 16, 17 and 18, the ratio varies from 3.20 to the thousand in Ward 6, to 1.05 in Ward 10. The average ratio for these wards is 1.77. The high rate in Ward 6 may be explained by the character of the population, which is composed of newly-arrived immigrants who are particularly susceptible to the disease, of laborers employed outside of the city in places where the water-supply is taken from wells, and of peripatetic merchants who are exposed to influences which are likely to cause typhoid fever. Ward 16, with a ratio of 1.94, the most crowded ward in the city having a population of 213 to the acre, the inhabitants of which, as a rule, remain at home during the entire year presents a marked contrast to Ward 6, with a ratio of 3.20. Concerning the other wards of the city proper, as the variation of the ratios is so little, the difference in elevation so slight, and the social conditions of the inhabitants so varied, it is impossible to draw any satisfactory conclusions regarding the prevalence of the disease. In Wards 13, 14 and 15, comprising South Boston, the highest ratio, 2.08, is reached in Ward 14, the lowest in Ward 15, .96. On general principles it would naturally be supposed, considering the character of the houses and their situation near tide level, that we should have a high ratio of cases of typhoid fever in Ward 15, and the only explanation of its comparative immunity is the fact that the majority of the inhabitants remain at home during the entire year and are not subjected to the influences of a contaminated water-supply. In Roxbury, which includes Wards 19, 20, 21 and 22, the ratios vary from 1.80 in Ward 19, to 1.44 in Ward 22. The morbidity of these four wards throws no light on the cause of the frequency of this disease. Ward 23, or West Roxbury, has a population of three to the acre, a maximum elevation of 301 feet above mean low water, and a minimum elevation of 35 feet. There is nothing in the natural condition of this ward that would seem to predispose to typhoid fever. The ward is not crowded, there is no made land in it; there are comparatively few tenement-houses, and yet its ratio of cases of typhoid fever is larger than in twenty of the other wards of the city. In only two instances during the past year have cases of typhoid fever occurred in houses where the water-supply was taken from wells, so that it is evident that contaminated wells have not been active agents in spreading the disease in this locality. In Ward 24, or Dorchester, which is not nearly so elevated as Ward 23, and in which there is a very considerable extent of marshy land, the ratio of cases to the thousand of inhabitants is 1.42, a considerable diminution as compared with Ward 23. In Ward 25, or Brighton, which is somewhat elevated and has a sandy soil, the ratio of cases to the thousand of the inhabitants is comparatively low, being 1.62.

Map E represents the city divided into sanitary districts according to the ratio of reported cases of typhoid fever to the thousand of population, for three years, from 1890 to 1892, inclusive. The districts are indicated by letters. Sanitary district A, consisting of only one ward, namely, Ward 15, has an average ratio for the three years of .96. Sanitary district B includes Wards 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 16, 18, 19, 20, 21, 22, 24 and 25. The average ratio of cases to the thousand of population is 1.53. Sanitary divis-

ion C, composed of Wards 2, 13, 14, 17 and 23, has a ratio of reported cases of 2.07. Sanitary district D, Ward 6, has a ratio for the three years, 1890, 1891 and 1892, of 3.20.

The influence of defective drainage on the prevalence of typhoid fever in this city is very slight, for of the 1,537 houses where the disease occurred during 1891 and 1892, only 699 were found to have broken or improper drains. Privy vaults are so few in Boston that they can have no causal relation to typhoid fever.

It has been shown, by the fact that typhoid fever has steadily diminished in Boston the past few years, that our water-supply is above suspicion. It has been proved by the statistics of the reported cases for the past three years, that neither situation, so far as tide level is concerned, nor a crowded condition of a locality are important agents in causing the prevalence of

MAP E.

typhoid fever. In order, therefore, to explain the frequency of the disease in Boston, it is a reasonable supposition that contaminated milk may be an active agent in spreading the disease. In the *Boston Medical and Surgical Journal* of July 19, 1888, is an extremely interesting and instructive paper by Dr. Charles Harrington, entitled, "An Epidemic of Typhoid Fever due to Infected Milk." This epidemic occurred during November and December, 1886, in the city of Cambridge. Investigation proved that 58 of 73 cases occurred in 36 families who obtained their milk from the same source. It was found that this milk came from a farm where there had been two cases of typhoid fever three weeks previous to the outbreak of the epidemic in Cambridge. As there was no local condition at this time to explain the outbreak of the disease, it therefore seems evident that the cases of typhoid fever on the milk farm were the cause of the disease in Cambridge. Prof. Wm. T. Sedgwick read a paper, January 26, 1893, before the Massachu-

setts Association of Boards of Health upon "An Epidemic of Typhoid Fever due to Infected Milk." After very carefully investigating the course of the epidemic, which occurred in Somerville, Prof. Sedgwick was thoroughly convinced, and with reason, that the cause of the outbreak of the disease was due to contamination of the milk by the discharges from a man in the first stages of typhoid fever. It was a significant fact that when this man was ill enough to go to bed the epidemic commenced to decline. It is unnecessary to more than allude to the many other instances on record where epidemics of typhoid fever can be absolutely traced to infected milk. As bearing on this fact, it is of interest to note that in the foreign cities where the ratio of deaths from typhoid fever is much lower than in this country, there is a most rigid and careful supervision of the milk farms both as to their sanitary condition and as to the health of the employes. In London, for instance, where typhoid fever is comparatively rare, large dairy companies have been formed whose supply of milk is based on most minute and rigorous regulations. To prevent the spread of infectious diseases by milk, the farmer is required by his contract to call a physician if any person employed in his dairy is taken ill. If the disease is infectious, the secretary of the company must be at once informed, who will indicate the measures to be taken. In the event of serious disease the delivery of milk from the farm is forbidden. Arrangements are made with local medical offices of health to obtain information as to each case of infectious disease arising in the neighborhood of a dairy. In Berlin, also, there are stringent regulations regarding persons who have come in contact with any infectious disease having anything to do with milk. Similar observations are true regarding Vienna and Glasgow. In Paris, a large proportion of the milk comes from dairies situated in the city. The employes of these dairies are subjected to a careful medical supervision, and it is very reasonable to suppose that this has a decided effect in reducing the death-rate from typhoid fever in that city. In Boston, the milk comes from so many different places and such long distances, and passes through so many hands that it would be difficult to absolutely trace the source of infection in a given case. But there can be no doubt that in Boston, as well as in many other cities, infected milk may be, and is, much more frequently than is generally supposed, a cause of an outbreak of typhoid fever. While this statement so far as Boston is concerned, may not be capable of positive demonstration, it is certainly worth the careful consideration of the members of this society.

It is perfectly evident from a study of typhoid fever in Boston for the past few years that the disease, in the different sections of the city, is not due to a common cause such as the water-supply, for if the water was at fault we should have practically the same ratio of cases in each of the wards. Such is not the fact, however, for we find as great a difference between the wards of the city as there is between Boston and London, and Boston and Philadelphia. It may be asked if contagion is not an element in increasing the frequency of the disease. In reply to this it may be said that such a small proportion of cases could be traced to any previous exposure, that no satisfactory deductions could be reached on this point.

An attempt has been made in this paper to show:

(1) That the prevalence of typhoid fever in Boston is not due to the water-supply.

(2) That situation near tide level is not conducive to the frequency of the disease.

(3) That imperfect drainage is not an important factor.

(4) That, as the germs of typhoid fever can be easily and readily conveyed by milk, it seems reasonable to assume that the comparative prevalence of the disease in this city is due, in a great measure, to infected milk.

THE SANITARY CONDITION OF BOSTON.¹

BY S. M. DURGIN, M.D.

THE sanitary condition of the city may be estimated in a variety of ways and with a greater or less degree of satisfaction. A superficial view of surfaces and surroundings may give sufficient evidence to one; the lack of prevailing bad odors, the want of a high death-rate, the absence of epidemic diseases or the existence of a well-ordered and equipped health organization may be satisfactory evidence to another, that the sanitary conditions are good.

All of these conditions might temporarily exist and furnish presumptive evidence of a good sanitary condition, while a careful investigation beneath surfaces and within doors, would alone furnish data upon which a positive statement could be made. A clean dry surface, a clean well-drained soil, good public and private sewerage, immediate destruction or removal of all decomposable wastes, good food and water-supplies, and a good surveillance over all, would constitute favorable conditions for a healthful city.

For the purposes of this brief paper, I shall confine myself to a statement of a few of the principal outdoor and in-door conditions as they appear to me. We cannot do better, perhaps, than to inquire as to how many of these favorable conditions we can lay claim to.

The area of the city now measures about 37 square miles, or 23,707 acres. Of this area, 1,812 acres are included in parks and public grounds. There are 558 miles of streets, of which 51 miles are paved, 204 miles are macadamized, and 282 miles are formed of gravel.

There are 56,809 dwelling-houses, and of this number there are 10,763 tenement-houses of three or more families each. A portion of the remainder of the city is occupied by various out-buildings for business purposes, leaving large tracts of unoccupied land, especially in the outlying districts.

The parks and public grounds for the most part may be said to represent good sanitary conditions. Some of the parks are not wholly completed but are rapidly approaching that desired end. The condition of some of the ponds will be improved by time; the pond on the public garden needs grading and paving for sanitary purposes. The paved streets have been greatly improved in the last two years, and, for the most part, are kept in a cleanly condition. Some of them, for the want of better paving, are very difficult to keep clean. Most streets in all cities present an unclean and offensive surface. This condition may be due to a faulty pavement, want of pavement, or a lack of care supported by a popular notion that an unclean and

muddy condition of the streets has no appreciable effect upon the public health.

The macadamized streets, where much used, are unclean and offensive at least six days in the week. It would be in the interest of the public health, a cleaner atmosphere, greater public convenience and economy if all the macadamized streets, within the built-up portions of the city, were paved with asphalt or hard brick with close joints.

There are large tracts of vacant land in the outlying districts and some lying nearer the centre of the city. Some of this land is at a low grade, and in portions of it are found creeks and ponds of more or less stagnant water. This water becomes offensive and troublesome when found within the neighborhood of dwellings by becoming mixed with drainage or other foul matters.

Difficulty has been found in various ways in securing a total abatement of many of these nuisances. A resort to the courts and the use of the city's money has resulted in the abatement of the larger and more serious specimens of this class of nuisances; but there are still many delinquent owners under orders, or whose cases are in court at the present time. An improved law for use in securing the filling of such lands to a proper grade is now under consideration at the State House. It would be difficult to say to what extent this class of external or distant nuisances affect the public health, but they are unsightly, noisome, sometimes extremely offensive to smell and, doubtless, to some extent, prejudicial to the health of those within their immediate vicinity.

A very large part of the occupied area of Boston, exclusive of Dorchester, Roxbury and Brighton, has been made by raising the grade of marshes and by filling on tide-water flats. This made land is found particularly in South Boston, Charlestown, East Boston, and at the so-called North, South and West Ends of the city.

This made land is occupied principally for dwelling purposes with a dense population, and partly for business purposes. The grade of the streets in these sections is from twelve to eighteen feet above mean high water, while the cellars are below average high water, are frequently wet, and many of those in the business sections are so low as to require boxing to keep out the tide and surface-water.

It does not necessarily follow that a territory will be unhealthy because the land is made by filling and reclaiming it from tide water. A healthful residence upon such soil depends rather upon the height of the surface of the soil above the ground water-level, the character of the soil between those levels and the exclusion of the soil air from the cellar. The cellar, situated near the ground water-level and in the unclean soil, must continually receive unclean and damp air from such a soil, unless provided by special means to prevent it. Portions of this land have been made with the refuse and dirt of the city, while other portions have been filled by clean gravel from suburban hills. The cellar in one case gets the foul and damp air from the soil, and in the other it is a question of shutting out the dampness from below. For the most part, the soil of the higher elevations of the city is damp and wholly without artificial drainage, while the filled portions are at too low a grade to exclude dampness without extraordinary means.

The alley-ways of the city are numerous, occupying

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