Half a century of sanitary progress, and its results / by H. Franklin Parsons.

HALF A CENTURY

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H. FRANKLIN PARSONS, M.D., PRESIDENT.

Reprinted from the TRANSACTIONS OF THE EPIDEMIOLOGICAL SOCIETY OF LONDON, *N.S., Vol. XVIII.*, 1898-9.

LONDON:
PRINTED AT THE BEDFORD PRESS, 20 & 21, BEDFORDBURY, W.C.

1899.

TRANSACTIONS

OF

The Epidemiological Society of London.

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INAUGURAL ADDRESS OF SESSION 1898–99.

Half a Century of Sanitary Progress, and its Results.

By H. FRANKLIN PARSONS, M.D., President.

(*Read: November 18th*, 1898).

Gentlemen,—In the first place let me thank you for the honour which you have done me in electing me President of the Epidemiological Society: an honour which I should scarcely have felt myself entitled to accept, had I not regarded it as intended for the Medical Department of the Local Government Board rather than for myself personally in virtue of any merits or qualifications of my own for the position. Conscious as I am of the difficulty of following worthily in the footsteps of the distinguished men who have preceded me in the office of President, I must crave your kind indulgence, and ask you to take the will for the deed.

In casting about for a subject on which I might profitably address you this evening, I remembered that it is now fifty years since the first general Public Health Act, that of 1848, was passed. The Annual Report of the Registrar General for 1896, published this year, completes also a fifty years' record of the deaths from different causes in England and Wales; since the classification of the causes of death, which had been suspended for several years, was resumed in 1847. It has occurred to me, therefore, that in this age of Jubilee celebrations it might not be inappropriate to take stock of our position, and endeavour to ascertain what measure of success has attended the legislative and administrative efforts which have been made during the past half century to improve the sanitary condition of this country, and to ward off the causes of prevent able—and especially of epidemic—diseases. In so doing I am well aware that a similar task has been already

performed, much better than I can do it, by my distinguished official chief and predecessor in this chair, Sir Richard Thorne, in his Presidential Address in 1887, on the Progress of Preventive Medicine in the Victorian era. I hope, however, to avoid taking you over quite the same ground.

Of the sanitary condition of England and Wales some half century ago, and more especially of the conditions of life in the poorer quarters of the larger towns, graphic accounts are to be found in the Reports of the Health of Towns Commission, published in 1844-5, which reveal a state of things almost incredible to us at the present day. Of fifty towns examined by the Commission, in scarcely one could the sewerage or drainage be considered complete and good, even according to the standard of that day; while in seven it was indifferent, and in forty-two decidedly bad as regards the districts inhabited by the poorer classes. In cases where the drainage of a town had been locally described as good, it was often found that only the principal streets had sewers, and even in those streets the houses were but imperfectly provided with house drains; while the most crowded portions of the town, those most densely inhabited by the poorer classes, were utterly neglected and had no drainage: the refuse being allowed to accumulate and decompose in open channels and pools, or to run into open and stagnant ditches in the immediate vicinity of the houses. Even where drainage works had been executed, the greater part had been constructed only on demands for the removal of pressing inconveniences and for the drainage of particular places. Moreover, the sewers were for the reception of surface water only: in some of the larger and most crowded towns all entrance into the sewers of house drains or drains from water-closets was prohibited under penalty; in others the entrance of house drains into the sewer was deemed the concession of a privilege, and was subject to regulations and payments which confined the advantage to the wealthy. Such sewers and drains as there were, were of imperfect construction, of brick or stone, commonly with flat bottoms—the use of earthenware pipes being mentioned as a novelty—and the inlets were untrapped and a source of noisome stenches. The form of privy in vogue at that time is not explicitly described, but it involved the storage of excremental filth in large quantities and for prolonged periods in the neighbourhood of houses—often, indeed, immediately under them. The houses of the wealthier classes were furnished with water-

closets discharging into cesspools, while elsewhere privies were in general use; these were often badly placed, and shared by a large number of houses. As regards water supply, in the great majority of the towns investigated, the mains were carried only through the principal streets. In a large proportion of the poorer districts the inhabitants had only out-door supplies by means of stand-pipes, or common tanks or wells; being in many instances obliged to fetch water from considerable distances, at much inconvenience, delay, labour and expense. In many towns, indeed, they were dependent for supplies either on collections of rain-water, or on water taken from adjacent streams, or pumped from springs frequently liable to be polluted Where a water-service existed the supply was commonly an intermittent one, which rendered necessary the use of water-butts or tanks, in which the water was liable to be deteriorated by impurities. Thus, a condition of things similar to that which during the recent scarcity of water in East London has given rise to such loud and general complaints, was fifty years ago quite the usual one.

One result of this universal fouling of the air, the soil, and the water supply, was the constant prevalence of fever. Dr. Southwood Smith in his evidence, referring especially to East London, says: "In every district in which fever returns frequently, and prevails extensively, there is uniformly bad sewerage and bad supply of water, a bad supply of scavengers, and a consequent accumulation of filth. The streets, courts, alleys, and houses in which fever first breaks out, and in which it becomes most prevalent and fatal, are invariably those in the immediate neighbourhood of uncovered sewers, stagnant ditches and ponds, gutters always full of putrefying sewage, nightmen's yards and privies, the soil of which lies openly exposed, and is seldom or never removed. It is not possible for any language to convey an adequate conception of the poisonous condition in which large portions of these districts always remain, winter and summer, in dry and rainy seasons, from the masses of putrefying matter which are allowed to accumulate."

Other medical evidence before the Commission showed that defective drainage, neglect of house and street cleaning, bad ventilation and imperfect supplies of water, contributed to produce atmospheric impurities which affected the general health and physical condition of the population: generating acute, chronic, and ultimately organic disease, especially scrofulous affections and consumption, in addi-

tion to the fevers and other forms of disease to which public attention had hitherto been chiefly directed.

At the time when this enquiry was made the distinction between typhus and enteric fevers had not been established, nor the propagation of the latter by the medium of specifically polluted drinking water ascertained; hence polluted water supply as a cause of disease receives less notice in these reports than insufficiency of supply for purposes of domestic cleanliness and drain flushing. There is reason to think that the prevalent fever comprised both typhus and enteric fever. The association of prevalence of phthisis and scrofula with filth conditions is of interest, in relation to modern views concerning the propagation of tuberculosis.

Among other unwholesome conditions then prevalent in the poorer parts of towns, upon which stress is laid by the Commissioners as conducing to disease and death, may be mentioned the want of surface cleanliness, especially in courts; nuisances from slaughter-houses, pigstyes and dunghills in crowded localities; crowding of houses on the ground without sufficient space for the access of light and circulation of air; cellar dwellings; overcrowding; and want of proper ventilation in dwelling-houses, schools and factories.

Nor were these evils confined to the towns, for, as the Commissioners say, "The most important evils affecting the public health throughout England and Wales are characterised by little variety, and it is only in the degree of their intensity that the towns exhibit the worst examples of such evils. Villages and clusters of houses inhabited by the poor are often under the influence of the same causes of disease, though their effect in such situations may be frequently rendered comparatively slight from the more free circulation of the external air. The vitiation of the atmosphere, from overcrowding and the absence of proper ventilation in individual apartments, produces in the rural districts the same disease that arises from the same causes in a town population."

In England and Wales, during the five years 1838-42, the average death-rate per 1,000 inhabitants was 22.1, of which 1.053, or 4 per cent., was due to "fever"; and in the four years 1847-50, out of an average annual death-rate of 23.4 per 1,000 inhabitants, 1.246, or 5.3 per cent. was due to fever. On the other hand, in the five years ending 1896, of an average annual death-rate reduced to 18.1 per 1,000 inhabitants, little more than 1 per cent. (.184) has been caused by the several forms of continued fever (see

Chart II). In London the death-rate from "fever" per 1,000 inhabitants was 1.339 in the three years 1838-40, and .979 in the ten years 1841-50; whereas in the five years ending 1896 it had fallen to .142.

Yet, grossly unwholesome as were the conditions under which the poorer inhabitants of our towns lived half a century ago, and great as was the consequent waste of human life, the health of the kingdom was even then far better than it had been in earlier times. Lord Macaulay, in his well-known comparison between the state of England at the death of Charles II in 1685, and that at the time when his History was written, in the middle of the present century, says: "Some frightful diseases have now been extirpated by science, and some have been banished by police. The term of human life has been lengthened over the whole kingdom, and especially in the towns. The year 1685 was not accounted sickly; yet in the year 1685 more than 1 in 23 of the inhabitants of the capital died. At present only one inhabitant of the capital in forty dies annually. The difference in salubrity between the London of the nineteenth century and the London of the seventeenth century is very far greater than the difference between London in an ordinary year and London in a year of cholera."

It is to be observed, lest we should be inclined to overestimate the effect of sanitary legislation, that the improved health of the country to which Lord Macaulay refers was due to the improved social conditions brought about by the increase of knowledge and the growth of civilisation, rather than to legislative or administrative efforts consciously directed towards the promotion of the public health. Before, therefore, we consider the action which has been taken during the past fifty years to improve the sanitary state of the country, and its effect upon the mortality and prevalence of epidemic diseases, it will be as well to glance at the social changes which have been in progress during the same period.

It will hardly be denied that the general prosperity and well-being of the masses of the population of this country has on the whole advanced during the past half century. Mr. Henry George, indeed, has said that under our present social system the rich are growing richer, and the poor are growing poorer. Whether or not this may be true of the extremes of the social scale, we need not stop to enquire; but it seems unquestionable that the intermediate classes, those in that happy position removed from the extremes of poverty and riches, in which the prophet prayed that

his lot might be cast, and more especially the great wage-earning class, are on the whole better off than they were fifty years ago. Wages have risen, the hours of labour have been shortened, and the necessaries of life have become cheaper, either actually or relatively to the wages earned. If house-rent has not fallen, the houses built for the working classes are healthier and more convenient than those built fifty years ago. The average price of wheat per quarter, which was 46*s.* 8*d.* in the five years 1847-51, and 62*s.* 1*d.* during the five years 1852-6 (which included those of the Russian war), was only 25*s.* 9*d.* in the five years 1892-6. The introduction of preserved foods from the colonies and abroad has increased the food supply, and brought a larger variety within general reach. Vegetables, fruit, and milk are more plentiful in our towns than formerly, and meat is in more general use. Unfortunately, the cheapening of agricultural produce has its darker side in the depression from which the agricultural classes have suffered during the past twenty years. Some other classes have also suffered through similar economic causes, *e.g.*, tin-, copper-, and lead-miners, and sugar refiners. But, owing to the increased means of communication, the effect of such depression in particular callings has been to cause the transference of labour to other callings, or to promote emigration, rather than to bring about anything approaching famine. There have been temporary and local periods of scarcity, due to loss of employment through strikes and severe seasons; and there is of course always more or less chronic distress in the poor quarters of our large towns; but since the cotton famine in Lancashire in the early sixties, there has been, so far as I am aware, no period of extensive scarcity in this country sufficient to produce a marked effect upon the public health. The proportion of persons receiving poor law relief per 1,000 population has fallen from 57 in the three years 1849-51 to 23.4 in the five years 1892-6. Prosperity, of course, has not been uninterrupted; there was a period of great prosperity in the later sixties and early seventies, followed by a period of depression in the late seventies and early eighties. The marriage rate and the birth rate have somewhat declined in recent years. (See Chart I.) Marriages of persons under twenty-one years of age became more frequent during the first half of the period, and were most numerous during the seventies; since then they have fallen off, but are still more frequent than in the late forties. The proportion of children born out of

wedlock has declined from 6.7 per cent. in the quinquennium 1846-50 to 4.2 per cent. in 1891-95. With the progress of education, the proportion of persons who signed the marriage register by mark has continuously declined—that of men from 312 per 1,000 in 1847 to 37 in 1896; and that of women from 455 in 1847 and 462 in 1850 to 43 in 1896. Education has become more general, especially since the passing of the Education Act of 1870, and its spread has done much to diminish the ignorance and prejudice which too often impeded the earlier efforts for the promotion of the public health. We may also note an increased sense of the responsibility of society for the welfare of its poorer and more helpless members.

Nor among the causes tending to the reduction of mortality must mention be omitted of the progress of curative medicine and surgery. For instance, the introduction of the antiseptic system, which has diminished so greatly the danger of surgical operations, can hardly have failed to produce an appreciable effect upon the death-rate. Deaths from accident and negligence have fallen from an average rate of 689 per million in the five years 1861-65 to one of 563.6 in the five years 1891-95, notwithstanding the increased use of machinery and the growing congestion of traffic in our streets. During the same period, the death-rate per million from diseases of organs of locomotion has fallen from 106.4 to 62.4, and that from diseases of the organs of generation from 62.0 to 48.6; both of these classes comprising diseases specially amenable to surgical treatment.

But side by side with the social changes favourable to the public health which I have mentioned, there has been one marked change tending in the contrary direction. I refer to the increasing aggregation of the population in the large towns, and the depopulation of the agricultural districts.

At the census of 1851 the population of England and Wales was nearly equally divided between the towns and country districts, 8,990,809 persons residing in the towns and 8,936,800 residing in country places. At the census of 1891, 20,895,504 persons resided in urban sanitary districts, and only 8,107,021 in rural sanitary districts. The proportion of persons living in urban districts to those living in rural districts in 1891 was 258 to 100; having risen from one of 212 in urban to 100 in rural districts at the census of 1881. The relative proportion of urban to rural population will, of course, vary according to the standard taken of what

constitutes a town. Many of the smaller "urban" districts are in fact mere villages, indistinguishable in character from those in the surrounding 'rural" districts, and if these be included among the rural population, the proportion of the latter will be increased; but on the other hand there are so-called "rural" districts with large and closely aggregated manufacturing and mining populations, living under urban conditions, though without the advantages of urban administration. The aggregate population of the rural sanitary districts in England and Wales increased by about 3 per cent. between 1881 and 1891; but in many of the counties the population of the rural districts declined during that period, though the falling-off in these was counterbalanced by the increase in population of rural districts in other counties, more especially in the manufacturing and mining parts of the country, and in the "residential" counties in the neighbourhood of London and other large towns.

At the census of 1891 the population of London exceeded the number of persons resident in England and Wales who were returned as born in London by 18 per cent., and a similar excess occurred in the manufacturing and mining counties; in Yorkshire it amounted to 6·5 per cent., in Lancashire to 19 per cent., and in Glamorganshire to 42 per cent, of the natives. On the other hand, in the case of the agricultural counties, the number of persons resident in England and Wales returned as born in those counties exceeded the resident population: in Huntingdonshire by as much as 38 per cent. of the latter. Again, the number of persons in England and Wales returned as agricultural labourers diminished from 870,798 in 1881 to 780,707 in 1891, a falling-off of 10.3 per cent. The occupation of an agricultural labourer, in spite of its hardships, is a very healthy one; its comparative mortality figure is only 66; that of all males being 100. In other words, only two agricultural labourers die, where in the general population among equal numbers of corresponding ages three males would die. It is evident, therefore, that the withdrawal from the population of so large a healthy constituent, or the transference of its members to other and less healthful fields of labour, must unfavourably affect the general death-rate of the country.

Among the causes which have brought about this transference of population from country to town may be mentioned the agricultural depression, the supersession of manual labour by machinery, and of water-power by steam,

and the growing preference for the advantages and excitements of a town life over the more monotonous if healthier country life. I do not think that it can be justly ascribed to our modern works of town drainage and water supply. The experience of other times and other lands shows that where the need of defence, commercial and industrial convenience, or social advantages, tends to collect people into towns, considerations of health are powerless to prevent this aggregation. Queen Elizabeth thought that London was too big in her day, and passed a law that no more houses should be built; so also did Oliver Cromwell: yet neither of these powerful rulers was able to restrain its increase. It is not the sanitary engineer who induces people to crowd together in towns. All that he does is to enable more people to live, in a tolerable state of health, on an acre or a square mile of ground, than could have existed there at all if all their refuse had had to be deposited on the area, and their water supply obtained from it.

But, nevertheless, the environments of people crowded together in towns—

> "In populous city pent,
> Where houses thick and sewers annoy the air,"

are, *cæteris paribus*, far less wholesome than those of persons living in the open country; the impurities resulting from the effete products of human beings are concentrated in a smaller compass; the purifying powers of vegetation and of the virgin earth are more or less wanting, owing to the ground being covered with buildings, roadways, and pavements; the wholesome rays of the sun are obstructed by smoke and dust; the circulation of the air is impeded; and the facilities for the propagation of infectious diseases are increased by the more frequent and closer contact of each individual with others. Hence the death-rate of urban districts tends to be constantly higher than that of rural districts. In England and Wales, during the ten years ending 1896, the average annual death-rate per 1000 estimated population was in town districts 19.5, and in country districts 16.9; while in earlier periods the difference in favour of the country was greater still. Moreover, a comparison of the crude death-rates of town and country districts does not exhibit to the full the greater salubrity of the latter; for it is commonly the younger adults, vigorous in body and mind, and in the actuarial sense, "better lives," who migrate to towns, leaving the older and less active and enterprising members in the country districts. Hence the age constitution of a rural population, as compared with that of an

urban population, is commonly such that, other things being equal, the former should experience the higher death-rate and the latter the lower; whereas, in actual fact, the reverse is the case; and when the death-rates for urban and rural districts are corrected for the age and sex constitution of the respective populations, the difference in favour of the latter is increased. Thus, to quote from a table in the Supplement to the Fifty-fifth Annual Report of the Registrar-General, the mean annual death-rate in England and Wales during the ten years 1881-90 was 19.08. In "urban England," viz., the aggregate of the seventy-eight principal towns, the death-rate was 21.08, and in rural England, comprising the remainder of the kingdom, it was 17.63. When, however, these crude death-rates are corrected for age and sex distribution, the urban rate is increased to 22.32, and the rural rate reduced to 16.95. In individual counties the effect of correction for age and sex differences is still greater: thus, for Huntingdonshire the comparative mortality figure is 730, and in Lancashire 1,268, that of England and Wales being 1,000: *i.e.*, to reduce the crude death-rates in these counties to a standard population, the death-rate in the former would have to be diminished by more than a fourth and that in the latter increased by more than a fourth.

The relation between density of population and mortality is well illustrated by a table in the same Supplement, in which groups of registration districts are arranged in order of their death-rates, corrected to a standard population. In the group of districts having the lowest corrected death-rate, viz., between 12 and 13 per 1,000 population, the density was 138 persons to a square mile; whereas in the group of districts having a corrected death-rate of 30 to 36 per 1,000, the density of population was 19,584 persons per square mile; and between these two extremes the corrected death-rate increased with the density in almost uninterrupted gradation.

As the density of the estimated population in England and Wales increased from 325 persons per square mile in 1851-60 to 470 in 1881-90 and 527 in 1896, and as the increase was not spread uniformly over the country but took place mainly in the towns, it is clear that the tendency of the change in the distribution of the population, apart from sanitary improvements, would have been to increase the death-rate and also the deaths from the different forms of infectious diseases and the infant mortality, all of which, in the Supplement from which I have quoted, are

shown to occasion a higher mortality in urban than in rural England.

The spread of infectious diseases is also favoured by the collection of children in schools for the purpose of elementary education: a condition which has greatly increased since the passing of the Education Act of 1870.

It may be feared, too, that modern ethical tendencies are not wholly in a direction to enhance a sense of parental duty, or of the value of infant life.

Let us now consider the efforts which have been made by the legislature during the course of the past fifty years for the protection of the public health. The era of sanitary legislation in this country may be said to have been inaugurated by the Public Health Act of 1848. It is true that, long prior to that date, the government of the country had concerned itself from time to time, as occasions arose, with the more exceptional and formidable epidemic diseases, such as plague, cholera, and yellow fever; and that there were some rudiments of sanitary machinery, such as the now obsolete courts leet, and commissions of sewers, but with imperfect powers and confused and overlapping jurisdiction. Certain towns also had obtained private improvement Acts containing clauses of sanitary bearing, but, in the words of the Commissioners in 1845, "these local Acts appear to have been framed more with reference to the means of traffic in the streets and the general convenience of the inhabitants, than with any regard to their health." Shortly before 1848, a number of Acts had been passed containing model clauses on various subjects which might be adopted in any local Act. These were of advantage in facilitating the drafting of local Acts and in securing uniformity, but they have in some cases had the undesirable effect of stereotyping arrangements which, though considered suitable at that time, have been shown to be inadequate or objectionable by the light of advancing knowledge and subsequent experience. Thus the insufficiency of legal powers to compel water companies to supply wholesome water, is due to the circumstance that the Waterworks Clauses Act, 1847, by which the rights and duties of water companies in the provinces are regulated, was passed before it had been discovered that specific epidemic diseases could be propagated by the medium of polluted water.

The Public Health Act, 1848, may, however, be considered the first general Act relating to the public health; for though applying only where adopted locally or put in

force, it created a central health authority charged with the supervision of the health of the whole kingdom, and with power to act in any place where local circumstances called for action.

The way for this Act had been prepared in the previous decade: first by the fatal cholera epidemic of 1831-2, which had forcibly directed attention to questions of the public health, and secondly by two Acts passed in the fruitful legislative period which followed the passing of the Reform Bill of 1832, viz., The Poor Law Amendment Act of 1834, which improved and rendered more uniform the administration of the law relating to the relief of the poor, and created a central supervising board; and the Registration Act of 1837, which furnished an accurate statistical basis for enquiries respecting the number, distribution, and causes of deaths. A series of reports issued by the Poor Law Commissioners, largely the work of the late Sir E. Chadwick, had shown how great a proportion of the pauperism then existing was due to diseases and deaths from preventable causes, and had led to the appointment in 1843 of the Royal Commission on the Health of Towns, whose Report I have already quoted from. This report formed the basis of the Public Health Act of 1848.

The Commissioners advised "That new legislative measures, applicable to all towns and populous districts, are required for the introduction and maintenance, not only of an efficient and economical system of house-drainage and sewerage, paving and cleansing, in all towns and populous districts, but also for providing ample supplies of water for public and private purposes, and for the adoption of other means for promoting and securing the health and comfort of the inhabitants. That in all cases the local administrative body appointed for the purpose have the special charge and direction of all the works required for sanitary purposes, but that the Crown possess a general power of supervision. That upon representation being made by the municipal or other authority, or by a certain number of the inhabitants of any town or district, or part thereof, setting forth defects in the condition of such place as to drainage, sewerage, paving, cleansing, or other sanitary matters, the Crown direct a competent person to inspect and report upon the state of the defects; and, if satisfied of the necessity, have power to enforce upon the local administrative body the due execution of the law. That the local administrative authority have power to appoint, subject to the approval of the Crown, a medical

officer, properly qualified, to inspect and report periodically upon the sanitary condition of the town or district, to ascertain the true causes of disease and death, more especially of epidemics, increasing the rates of mortality, and the circumstances which originate and maintain such diseases, and injuriously affect the public health of such town or populous district."

The sanitary improvements upon the need for which most stress was laid by the Commissioners were sewerage and house-drainage. Other recommendations related to paving, scavenging, abatement of nuisances, regulation of offensive trades, sufficiency of water supply, width of streets, courts and alleys, cellar dwellings, privy accommodation, ventilation of public buildings, and regulation of common lodging-houses. The Commissioners did not see their way to make any recommendation with respect to open space at the back of houses, nor with respect to the ventilation of houses; and their only recommendation directly relating to infectious diseases was "that on complaint of the parish medical or other authorized officer, that any house or premises are in such a filthy and unwholesome state as to endanger the health of the public, and an infectious disorder exists therein, the local administrative body have power to require the landlord to cleanse it properly without delay; and, in case of his neglect or inability, to do so by its own officers, and recover the expense from the landlord."

Had the medical element been more strongly represented on the Commission—which contained only two medical members, viz., Sir Richard Owen, whose subsequent fame as a comparative anatomist may have thrown into the shade his earlier labours as a sanitarian, and Sir J. Ranald Martin — it is possible that more stress would have been laid on the need for directly opposing the spread of infectious diseases by measures of isolation and disinfection. But at that time medical knowledge concerning the propagation of fevers by specific contagia was less definite than it is now; and probably public opinion would not have sanctioned the expense of establishing isolation hospitals, or have approved any measures which savoured of interference with the liberty of the subject. It has doubtless been well for the country that the earlier efforts of sanitary reformers were directed towards promoting a condition of cleanliness unfavourable for the propagation of epidemic diseases, rather than towards combating these diseases by restrictive measures akin to

quarantine; but the course adopted has had the disadvantage that, when the question of hospital provision for infectious cases came to be taken up, it was done by the State for Poor Law purposes, and was thus started on a wrong track, as a measure for the relief of necessitous individuals rather than as one for the protection of the public health.

The Public Health Act, 1848, created a central board, the General Board of Health, with large powers, and authorised the formation in any place of a Local Board of Health, either upon the petition of not less than a tenth of the inhabitants or, where the average death-rate for a period of seven years exceeded 23 per 1,000, upon the initiative of the General Board of Health. It gave legal effect to the various recommendations of the Health of Towns Commission, and made the necessary financial and administrative provisions for carrying them out; and its clauses form in the main the basis of the Public Health Act, 1875, now in force. It applied, however, for the most part only in places where local boards of health had been formed, but one clause (§ 50) provided that in any parish or place containing less than 2,000 inhabitants the ratepayers in public meeting assembled might, by a majority of three-fifths, take steps for the cleansing, covering, and filling up of any pond, pool, open ditch, sewer, drain, or place containing, or used for the collection of, any drainage, filth, water, matter, or thing of an offensive nature or likely to be prejudicial to health; the making or improvement of a sewer, or the digging of a well, or providing a pump for the public use of the inhabitants. The work was to be done by the churchwardens, after approval at a second public meeting of ratepayers, at the cost of the poor-rate. The cumbrous procedure of this clause appears, however, to have been little resorted to in rural places.

The General Board of Health, as at first constituted, was a very able and vigorous body, but being too much in advance of public opinion, its constitution and powers were altered in 1854; and in 1858 it came to an end, its functions being divided between the Privy Council and the Home Office. This arrangement continued until 1871, when the Local Government Board was formed with the duty of supervising the administration both of the Poor Law and of the Sanitary Acts. The facilities for obtaining local self-government by the formation of local boards were extended by the Local Government Act of 1858,—too much so, indeed, for it became the fashion in some

parts of the country for mere villages or rural parishes to constitute themselves "urban districts" for the sake of escaping inclusion in a highway district, or of evading the carrying out of sanitary works. The last-named Act gave in urban districts a most important power, viz., that of making bye-laws with respect to the walls, foundations, etc., of new buildings for stability and the prevention of fires—subsequently extended to purposes of health—to the sufficiency of open space about buildings for the circulation of air, to the ventilation and drainage of buildings, and to water-closets, earth-closets, privies, ashpits, and cesspools in connection with buildings. Model bye-laws with respect to these matters were issued by the Home Office, and subsequently a more complete and explicit code has been framed by the Local Government Board. These bye-laws have been extensively adopted, and have probably done more than anything else to prevent the further creation in our towns of crowded slums and fever dens such as existed fifty years ago.

In rural districts, however, not only were the legal powers for the protection of the public health before 1872 far less ample than those of local boards, but such powers as existed were divided between two sets of authorities: viz., the "Nuisance Authority," under the Nuisance Removal Acts—that is to say, the Poor Law Guardians, and the "Sewer Authority," under the Sewage Utilization Acts —that is to say, the vestry in each parish; hence it is not surprising that but little was done before 1872 for the improvement of the sanitary condition of rural districts. The nuisances for the abatement of which powers were given by the Nuisance Removal Act, 1855, appear to comprise only things which stink; but the definition was subsequently enlarged so as to include overcrowding, ill-ventilated workplaces, and the emission of black smoke from chimneys other than those of dwelling-houses.

Other Acts passed during the period relate to the provision of burial grounds, and of public baths and washhouses, and the regulation of common lodging-houses.

Hitherto, the only Acts for the direct combating of infectious disease by such measures as disinfection and the provision of hospital accommodation and medical attendance were the Disease Prevention Acts, very inappropriately so named, since they were only to be put in force by the central authority when some part of the country was already affected by a formidable epidemic, and in practice were put in force only in the case of an exotic disease such

as cholera. The Sanitary Act of 1866 made an important extension of the scope of the law in this direction. It empowered the provision of hospitals or temporary places for the reception of the sick, and the removal thereto under order of a Justice of any person suffering from any dangerous infectious disorder who was without proper lodging or accommodation, or was in a room occupied by more than one family, or on board any ship or vessel. It also empowered the provision of an ambulance for the removal of the sick, and of a place for the disinfection of woollen articles, clothing, or bedding which had become infected, and the compulsory cleansing and disinfection of infected houses, and articles in them likely to retain infection. It forbad the exposure of an infected person in any public place, or the use by him of any public conveyance without notice to the driver; also the giving, lending, selling, or exposing of infected articles, and the letting of infected houses or rooms.

These powers, however, being conferred some upon "nuisance authorities" and others upon "sewer authorities," were little, if at all, used in rural districts where the "nuisance authority" and the "sewer authority" were different bodies of men.

In 1869 a Royal Commission was appointed to inquire into and report upon the operation of the sanitary laws in England and Wales (except London) so far as they apply to sewerage, drainage, water supply, removal of refuse, control of buildings, prevention of overcrowding, and other means of promoting public health, and for preventing the introduction and spreading of contagious and infectious diseases, and epidemics affecting the health of man; also into the constitution of the central and local authorities charged with the administration of these laws, and the formation of proper areas, and into that part of the registration system which relates to certificates of causes of death, and to suggest improvements in all or any of these matters.

The outcome of the report of this Commission was the passing of the Public Health Act, 1872, which marks a second important epoch in the public health history of this country. Hitherto, the progress of sanitary improvement had been fitful and partial, and had been confined to the towns, the rural districts being little if at all affected by it; but from this date there has been, speaking generally, a steady advance all along the line, though of course all places have not participated in this advance to an equal extent.

The Act of 1872 created two classes of inland sanitary authorities, viz., urban and rural, the Urban Sanitary Authorities being the Town Councils of boroughs, the Improvement Commissioners in districts under local Acts, and the Local Boards in other towns, the Rural Sanitary Authorities, being the Boards of Guardians in whom were vested the powers both of "nuisance authorities" and "sewer authorities" under the earlier Acts. The sanitary powers of the "parish," more often used to obstruct than to promote sanitary improvement, thus ceased, except where delegated by the Rural Sanitary Authority to parochial committees; but certain limited sanitary functions have recently been assigned to parish councils under the Local Government Act of 1894. There were also formed Port Sanitary Authorities, consisting of representatives chosen by the riparian authorities.

Each of these several authorities was now obliged to appoint one or more medical officers of health; whereas previously only urban authorities had the power to make such an appointment, and it was optional upon them whether they did so.

The codification of sanitary law in the Public Health Act, 1875, greatly aided sanitary administration, and further powers with respect to the notification and prevention of infectious diseases, the provision of isolation hospitals, and other sanitary purposes, have been conferred by more recent Acts; while the urban and rural sanitary authorities, under the name of District Councils, have been placed on a more popular elective basis.

The creation, in 1888, of County Councils as a supervising body in each county has tended to stir up the more sluggish local authorities to a better performance of their duties, more especially in counties where the County Council has exercised its power of appointing a county medical officer.

In London, a system of local authorities, in the form of elective vestries, was created by the Metropolis Management Act of 1855; and for purposes affecting the Metropolis as a whole, the same Act also formed the Metropolitan Board of Works, a body to whom London owes its main drainage system and the embankment of the Thames. This Board was superseded in 1888 by the London County Council, and London sanitary legislation, which had lagged behind that in force in the provinces, was extended and brought up to date by the Public Health (London) Act, 1891.

The provision of isolation hospitals in the Metropolis

still rests however with a Poor Law body; although since 1889 the hospitals of the Asylums Board have been available for persons other than paupers, and their use no longer involves the disqualifications attaching to the receipt of Poor relief.

One other important means for the prevention of disease is also still in the hands of the Poor Law authorities, both in London and the provinces: I allude to vaccination. The earliest step taken by the State for the promotion of vaccination was the foundation, early in the century, of an establishment for the gratuitous distribution of vaccine lymph. In 1843, Boards of Guardians were authorised to contract with medical practitioners for the gratuitous performance of vaccination. In 1853, on the representations of this Society, an Act was passed rendering vaccination obligatory, but no machinery was appointed for enforcing the duty. This omission was supplied by the Vaccination Act of 1869, and the Act of 1871 rendered compulsory the appointment of an officer charged with the duty of enforcing the Vaccination Acts. Of late years, however, owing to an organised opposition to vaccination, its enforcement by the Guardians has ceased in many parts of the country, and the number of vaccinations has greatly fallen off; of the children whose births were registered in 1894, the last year for which figures are available, the proportion not finally accounted for as regards vaccination was 19.5 per cent., viz., 20.6 per cent. in London, and 19 per cent. in the provinces. This is the highest proportion in any year since 1872, the figures in previous years having been as low as 5.7 per cent. in London in 1881, and 3.8 per cent. in the provinces in 1875. In the recent Session of Parliament an Act has been passed relieving the "conscientious objector" to vaccination, and superseding the system of arm-to-arm vaccination, which has hitherto been recognised, by one of domiciliary vaccination with glycerinated calf-lymph. How far this change will conciliate the opponents of vaccination, or secure a larger percentage of vaccinated children, it is as yet too soon to judge.

We may now glance briefly at the chief sanitary improvements which have been effected as the outcome of the legislation of which I have given a summary.

At present all the larger towns of the country, and most of the smaller ones, are more or less completely sewered; the chief exceptions being some Kentish towns, in which

cesspools leaking into the chalk afford an only too easy method of getting rid of sewage; and some towns in the coal-mining districts, where difficulty arises through the subsidence of the ground which takes place after coal-getting. The disposal of sewage is a problem still not solved; subsidence, filtration and irrigation, chemical, electrical, and biological methods have all been tried, and not a year passes without some new method being brought forward; but the hopes formerly entertained of making a profit out of it have been doomed to disappointment, and all that is now aimed at is to render it innocuous at a moderate cost. Some steps have been taken to purify our rivers, but much more remains to be done in this direction. In proportion, however, as rivers become disused as sources of domestic water supply, their pollution, however objectionable on æsthetic grounds, loses a good deal of its importance from a health point of view. Even if all sewage could be excluded from our rivers they would still, in all but the uppermost portions of their course, be too much exposed to pollution of other kinds, such as manufacturing refuse, muddy water off roads, surface washings off manured fields, decaying vegetable matter, droppings of cattle, and sheep washing, to be a proper source of drinking water, at any rate without thorough filtration.

The construction of house drains (though of course scamped work is still only too frequently met with) has been greatly improved, especially since the introduction of the water test as a means of ascertaining their imperviousness. Their ventilation, efficient trapping, and severance from direct communication with the interior of houses, are important features of modern drains.

A noteworthy result of efficient drainage, coupled with the enforcement of proper building regulations, is that well-administered towns become healthier as they increase in size, since the central and closely-built parts are converted into business quarters, and the population is transferred to new suburbs, well laid out and built on virgin soil, which, where sewerage has been constructed when building first commenced, has never been impregnated with the soakage from privies and cesspools.

The earlier sanitary reformers, impressed by the evils accruing from the accumulation of human excrement in privies and cesspools in the immediate neighbourhood of dwellings, strongly urged its removal through the sewers by means of a water-carriage system. At that time, however, not only was the construction of sewers and drains

imperfect, but the proper details of the closet arrangements had not been worked out, nor were people of the working-class educated to the use of water-closets. In consequence, evils such as blocked drains, filthy pans, and escape of foul air into houses, were of frequent occurrence, and a further danger was the liability of foul matter being sucked up into the water pipes through their direct connection with the closet pans. Hence, some thirty years ago, there was a reaction in favour of the so-called "dry" or "conservancy" methods, by which excrement was stored up for more or less prolonged periods in the neighbourhood of houses. At the present time, however, these conservancy methods are being rapidly superseded in our towns by the water-carriage system. In the towns of the South of England the latter method is now nearly universal, and the Midland and Northern towns are getting dissatisfied with their midden privies and pail closets, and are coming to favour the more cleanly method on economical as well as on sanitary grounds. It is found that the collection and carriage of night soil does not pay, as in the present state of agriculture there is little or no demand for it; and it has to be got rid of by burning in destructors, by barging it out to sea, or by tipping it into quarries and waste places. As an abstract principle we may regret that so much potentially valuable fertilising material should be wasted: and should the failure of our wheat supply for want of fixed nitrogen, which Prof. Crookes foresees, ever become imminent, the excremental refuse of our large towns may acquire a market value sufficient to pay for its removal in the dry way with the frequency demanded in the interests of health; but under present circumstances its economic value certainly does not outweigh the sanitary disadvantages attaching to its storage and collection by any methods hitherto found practicable in such districts.

As regards water supply there is not one of our large towns, and there are few of the smaller ones, which have not a public water service, and shallow wells in towns have fallen into more or less complete disuse as a source of drinking water, especially where the public supply belongs to the local authority. Much pains and expense have been incurred to secure water from pure sources, as deep wells and upland streams and gathering grounds, in place of supplies taken from polluted rivers; some towns, as Liverpool, Manchester, and Birmingham, having brought water at vast cost from distant mountain regions. Where, as in the

case of London, the supply continues to be taken from rivers, the need for efficient filtration is recognised.

As regards means of combating infectious diseases, the notification of such diseases is now compulsory in districts having an aggregate population, according to the 1891 census of nearly twenty-eight out of the twenty-nine millions in England and Wales.

The provision of hospitals for the isolation of infectious diseases has made great progress in recent years. Besides London, the needs of which in this respect are supplied by the Metropolitan Asylums Board, I find from a Parliamentary Return, published in 1895, that out of 1,653 sanitary authorities, urban, rural, and port, 631 had up to the end of 1892 made, alone or jointly with other authorities, some sort of provision for the isolation of infectious cases. Since that date the establishment of isolation hospitals has been much extended, 216 loans for hospital purposes—not all, however, relating to different hospitals—having been sanctioned by the Local Government Board in the five years 1893-7; while many other authorities have provided themselves with accommodation without the aid of loans. The use of hospitals has also become much more general, as the prejudice with which they were at first popularly regarded has disappeared with experience of their benefits, and as their use has been made free without charge; so that in some districts a very large percentage of the cases of diseases, such as scarlet fever, are now isolated in hospital. The use of steam for disinfecting articles of clothing and bedding has also extended. Time would fail me to allude to the many other directions in which a care for the public health is manifested, either by the provision of appliances for promoting and safeguarding it, or by the supervision and regulation of places and processes which may involve danger to it.

In rural districts, especially in the unprogressive parts of the country, less has been done in the way of sanitary improvement than in the towns: partly because in such districts public opinion is less advanced; partly because in a more sparse population collective systems of drainage and water supply are less needed than in a closely aggregated one; and partly also on account of the financial difficulties arising from agricultural depression, and from the want of power in the present state of the law to apportion the cost of sanitary improvements upon the part of a parish benefited by them. Still, in most rural districts more or less supervision is exercised over matters affecting

the public health, and detailed improvements are made as required. Urban powers, too, have of late years been more frequently granted and exercised in the more populous rural districts.

Turning now to consider the results which have followed the changes of which I have spoken, we find in the first place that, notwithstanding the adverse effect of the increasing aggregation of population in towns, there has been during the past fifty years a great diminution in the death-rate from all causes.

The average annual death-rate per 1,000 persons living, which was 23.1 in the five years 1847-51, was in the period 1892-6 only 18.1 : a saving of life of five persons annually in every thousand, or 145,000 in the population of England and Wales as enumerated at the census of 1891.

The diminution of the death-rate has been greater in the towns than in the country districts, it having fallen in the former from 24.7 in the ten years 1851-60 to 20.3, in the ten years 1881-90, and 18.8 in the five years 1892-96; while the rural death-rate fell from 19.9 in the ten years 1851-60 to 17.3 in the ten years 1881-90, and 16.7 in the five years 1892-96. The average death-rate in the thirty-three great towns of England and Wales in the five years 1892-96 (20.0) is almost as low as that (19.9) in the country districts in 1851-60.

That this reduction in the death-rate is due in the main to sanitary improvement rather than to improved social conditions appears probable when we follow its course in five-yearly periods. In the period 1847-51, a period marked by epidemics of cholera and influenza, as well as of fever (largely typhus), the death-rate was 23.1. In the next five years, corresponding to the brief but vigorous reign of the first General Board of Health, it fell to 22.4, but notwithstanding the general prosperity of the country it remained almost unaltered at this point for twenty years. In the five years, however, which followed the passing of the Public Health Act, 1872, it fell from 22.3 in the preceding period to 21.6, and there has been a steady decline in each successive quinquennium since then to 18.1 in the five years ending 1896 (see Chart I). This conclusion as to the reason for the decline in the death-rate is strengthened when we examine the tables of the Registrar-General with a view to ascertain from what causes the deaths have diminished. It will be found that this has been largely in the diseases of the "zymotic" class, and in this class, among

those diseases which are most amenable to preventive measures in so far that their natural history is best known, and that they are popularly esteemed of sufficient gravity to warrant the expenditure of money and the taking of pains for their prevention. Thus the death-rate per million inhabitants from small-pox fell from 312 in the period 1847-52 to 12 in 1887-91. The death-rate from continued fevers fell from 1,184 in 1847-51 to 184 in 1892-96; and that from "cholera" from 660 in 1847-51 to 23 in 1892-96, while that from scarlet fever declined from 1,001 in 1862-66 to 118 in 1892-96. The mortality from continued fevers, like the general death-rate, fell between the quinquennium 1847-51 and 1852-56, but then remained at nearly the same height until 1872, since when it has rapidly declined (see Charts II, IV and V).

The lessened mortality of recent years has not, however, been shared equally by persons of all ages; the gain has been in the earlier periods of life, and a smaller proportion of persons live to extreme old age at the present time than did half a century ago. More persons reach adult age now than formerly; but of those who reach middle age the expectation of life is, *cæteris paribus*, somewhat less than it was fifty years ago. In a comparison of several successive life tables, given in the Supplement to the 55th Annual Report of the Registrar-General, it is shown that in England and Wales the mean expectation of life at birth for males was, in the period 1838-54, 39.91 years; in 1871-80, 41.35 years; and in 1881-90, 43·66 years. In certain selected healthy districts it was in the period 1849-53, 48.56; and in 1881-90, 51.48 years. Females live longer; their mean life-time in England and Wales was in 1838-54, 41.85 years; in 1871-80, 44.62 years; and in 1881-90, 47.18 years. In the standard healthy districts it was in 1849-53, 49.45 years, and in 1881-90, 54.04 years. Thus, in each case there was in 1881-90 an increased expectation of life at birth ranging between 3 and 6 years. But at ages from 27 years onwards in the case of males, and from 45 years onwards in the case of females, the mean expectation of life was less in 1881-90 than in 1838-54. Even in the standard healthy districts there is a similar diminished expectation of life in 1881-90 as compared with 1849-54, though the diminution begins to occur later than in the kingdom generally, viz., at 32 years in the case of males, and at 48 in the case of females. We may infer that while the sanitary improvements of the past half century have diminished the fatality of the infective diseases of earlier life, they have done

little to postpone the degenerative changes of later life; and that though the present conditions of life are favourable to the survival of the young, the increased wear and tear of our strenuous modern life, especially in towns, bring about an earlier final breakdown of the vital machinery. Moreover, it is probable that a number of weakly lives, which under the less favourable conditions of fifty years ago would have been extinguished in childhood, are now enabled to survive into adult life, though they have not sufficient vitality to reach old age.

Looking at the Registrar-General's table, which shows the average annual death-rates from various causes in successive groups of years, we find that while the deaths from old age have diminished from 1,352 per million living in 1861-65 to 929 per million in 1891-95, on the other hand, during the same period those from cancer have increased from 368 to 712 per million; those from diabetes from 29 to 69 per million; those from diseases of the circulatory system from 996 to 1,677 per million; those from diseases of the urinary system from 246 to 453 per million; and, what is probably of a significance greater than the actual figures, those from intemperance have increased from 41 to 68 per million.

The infant mortality shows, unfortunately, but little diminution during the fifty years under review. The deaths of infants under one year old out of 1,000 born, were 156 in the five years 1847-51, and remained at about the same figure till 1876. In the period 1877-81 the infant mortality fell to 141 per 1,000 born, but has since again risen to 151 in the years 1892-96. Among the principal causes of death in infants under one year are measles and whooping-cough; diarrhœa and enteritis; tabes mesenterica, and other tubercular affections; premature birth, convulsions and dentition; bronchitis and pneumonia; debility and atrophy. From some of these causes, as premature birth, the mortality is increasing; from others, as convulsions and dentition, the apparent mortality is decreasing, perhaps mainly as the result of more careful and definite certification.

Changes of practice and fashion iu the certification and classification of diseases have indeed an influence not to be ignored in the apparent increase or diminution of the mortality from particular diseases. In recent years, with the advance of medical knowledge there has been increased accuracy and definiteness in certifying the cause of death; and more especially since the Registrar-General has adopted

the practice of asking by letter for supplementary information concerning deaths from vaguely certified causes. Hence there has been a great diminution in the number of deaths certified from ill-defined causes, such as dropsy, tumour, abscess and mortification, and from causes such as convulsions, of which the certification is based on a prominent symptom rather than on the essential nature of the disease. This tendency will have to be borne in mind in considering the mortality from certain epidemic diseases, as diphtheria, diarrhœa, and fever. Of the epidemic diseases with which we as a Society are especially concerned, we find that during the fifty years under review the mortality from continued fever and cholera, disease against which sanitary efforts from the first have been specially directed, has steadily declined throughout the period. In the case of other diseases, as scarlet fever and diarrhœa, the mortality rose to a maximum about the middle of the period, and has since declined to below what it was at the commencement. Whooping-cough and measles show little or no reduction; while the mortality from diphtheria and influenza, after having declined, has increased in recent years. Phthisis and other tubercular diseases have declined.

We may consider in a little more detail these several diseases as factors in the mortality of the past fifty years.

Cholera was epidemic in the years 1847 and 1848, and again in 1853-54. It is an oft-told tale how, in South London, it fell with different incidence upon the houses supplied by the two water companies whose mains ran side by side, and how the customers of one company who suffered the more in the earlier epidemic, suffered the less in the second epidemic, the company having in the meantime removed its intake higher up the river and improved its filtration. In 1866 epidemic cholera again occurred, and again it was found in East London to be associated with the distribution of water polluted by specifically infected sewage. Since 1866 Asiatic cholera has never become epidemic in England; for though during recent decades it has been epidemic in neighbouring European countries, and cases have been imported from time to time, yet either they have been arrested by the system of port sanitary defence organised in recent years, or if they have passed it, the seed has not fallen in a congenial soil, and the disease has died out without propagating itself. The only exception was in 1893, in which year epidemic cholera gained some footing in Grimsby—a town in which enteric fever

and diarrhœa are endemically prevalent—and from thence a certain number of cases of cholera were disseminated over neighbouring counties, largely through the agency (as there is reason to believe) of shell-fish taken from the sewage-polluted tidal waters. Apart from epidemic years, a certain number of deaths are returned from "cholera" year by year, their number varying with that of the deaths from "diarrhœa;" and they represent a severe form of that disease, rather than true cholera (see Chart II).

From "Fever" the death-rate has very markedly declined between 1847 and the present time, and since 1866 with a continuous steady fall. In 1847 the distinction between typhus and typhoid fevers had already been pointed out by Dr. A. P. Stewart, and it was confirmed by Sir W. Jenner in 1849. It was not, however, made in the Registrar-General's classification until 1869; and even after that date the different kinds of fever were but imperfectly distinguished by the older generation of medical men. Hence, among the deaths ascribed to typhus and to simple and ill-defined fevers in the earlier years after 1869, there were probably many which should have been ascribed to enteric fever; and the more rapid diminution in the number of deaths from the first-mentioned forms of fever than from enteric fever, is partly due to the transference of cases from the two former categories to the latter as medical diagnosis improved (see Chart III).

Typhus is known to have been very prevalent in England in 1847 and 1848, the years immediately following the failure of the potato crop in 1846, which drove a large number of destitute Irish to this country. With the regulation of common lodging-houses, the closing of cellar dwellings, and the improvement of the dwellings and of the general condition of the working classes, it has steadily declined, until it is now so rare a disease that comparatively few medical men have ever seen it. It is still met with among the colonies of squalid Irish congregated in our large towns, especially in Lancashire, but when it breaks out elsewhere its spread is generally due to the failure to recognise at the outset a disease so unfamiliar.

Enteric fever, on the other hand—though its mortality has also declined, and in 1892-96 was less than half wha it was in 1869-71—is much more frequent and generally distributed than typhus, and is now not much more fatal in the large towns than in the rest of England and Wales. Generally speaking, it is more prevalent in the north than in the south of England, the counties in which it has occa-

sioned the highest mortality during the past ten years being Durham, Yorkshire, Lancashire, Nottinghamshire, South Wales, Cheshire, Northumberland, and Staffordshire. These counties contain, besides large towns, many populous mining and manufacturing places of recent growth, in which drainage, water supply, and sanitary administration generally are as yet very imperfect, and in which the midden privy still prevails in all its primitive nastiness.

It is somewhat difficult to appraise the respective effects of the several measures by which the prevalence of enteric fever in our towns has been lessened; but the most potent, probably, is the introduction of a supply of pure water to replace a contaminated supply from wells and other local sources. Many instances could be quoted in which towns in which enteric fever was endemic have become practically free from it on the introduction of a supply of water from an extra-mural source. On the other hand, a public water service, should it become specifically contaminated, gives opportunity for an epidemic of enteric fever, on a scale of magnitude and with a rapidity of development far exceeding what was possible when the water supply was obtained from a number of different sources.

The following are some instances in recent years of typhoid epidemics of water origin in towns ordinarily comparatively free from that disease.

Town.	Population, estimated.	Duration of Date of Epidemic.	Cases.	Deaths.	Rates per 1,000 Inhabitants.	
					Cases.	Deaths.
		1882.				
Bangor ...	15500	3½ months, May-Sept.	548	42	35.3	2.7
		1884.				
Beverley ...	11425	2½ months, June-Aug.	231	12	20.0	1.2
		1884.				
Kidderminster	25500	3½ months, Aug.-Nov.	1200	89	47.0	3.5
		1893.				
Worthing ...	19290	7 months, May-Nov.	1411	186	73.0	9.6
		1894.				
Newport, I. of Wight	13533	3½ months, Aug.-Dec.	516	57	38.1	3.77
		1897.				
Maidstone ...	33830	2 months, Sept.-Oct.	1847	132	54.6	3.9

Next in importance to a pure water supply in the reduction of enteric fever prevalent in our towns is the prompt conveyance of excretal matter out of them, instead of storing it up in their midst. Broadly speaking, it may be stated that water-closet towns have a lower typhoid mortality than privy-midden towns. According to figures collected by Dr. Scurfield, Medical Officer of Health for Sunderland, in the six years 1890-95, the death-rates per 1,000 inhabitants from "fever", in thirty-one privy-midden towns, averaged 0.26, while in twenty-five water-closet towns they averaged 0.15. The corresponding rates for diarrhœa were 1.08 and 0.52 respectively in the two classes of towns. It has also been found in many instances that in the same town the incidence of enteric fever is greater on houses with privies than on houses with water-closets.

Further light on the cause of the endemic prevalence of enteric fever in certain towns has been thrown by recent researches, which show that the Bacillus typhosus is capable of long retaining its vitality in porous earth containing an excess of organic matter. This may help to explain how it is that in towns of which the site and subsoil have been allowed to become sewage-sodden, the carrying out of sanitary works does not always at once reduce the prevalence of enteric fever. In the same way the drainage of the fens did not at once stamp out ague, but the disease gradually declined, until it is now almost extinct.

Diarrhœa has in its epidemiological aspects several points of similarity to enteric fever. Both diseases attain their greatest prevalence in the late summer and autumn, though earlier in the case of diarrhœa than in that of enteric fever, and the years which are marked by an excessive mortality from the one disease are usually marked by an excessive mortality from the other also; as was the case in 1893 and 1895, and probably also in 1849, 1852, 1854, 1857, and 1865, in which years the mortality both from diarrhœa and "fever" was excessive, though at that time the several forms of fever were not separately classified. In some towns also, as at Nottingham and Grimsby, Preston and Sunderland, both diseases prevail endemically, though in others no such concurrence is observed. Again, epidemics of enteric fever have not unfrequently been preceded by an unusual prevalence of diarrhœa; this was the case with those at Kidderminster and Maidstone, mentioned in the table previously given. But while the mortality from enteric fever has greatly and almost con-

tinuously declined during the last fifty years, that from diarrhœa fluctuates greatly from year to year; and though it has, on the whole, declined since the period 1867-71, the diminution has been much less in proportion than that of enteric fever (see Chart II). Indeed, it may be doubted whether the apparent decrease in recent quinquennia is not mainly due to the transference of deaths from the heading of "Diarrhœa" to that of "Enteritis." The deaths under the latter heading have greatly increased in recent years; having been at the rate per million inhabitants of 108 in 1877-81, 118 in 1882-6, 156 in 1887-91, and 270 in 1892-6. There is an objection on the part of some medical men to the use of the word "diarrhœa," partly (especially in health resorts) on the ground that the deaths from diarrhœa are reckoned in the "Zymotic mortality," to the discredit of the district; partly on the ground that diarrhœa is a symptom of many diseases, rather than a disease in itself. There can, however, be no doubt that the summer diarrhœa which causes such a heavy mortality among infants, especially in certain towns, is a definite disease owning a specific cause; and unless a better term can be found, and its universal acceptance secured, a change from the established nomenclature is to be deprecated.

The mortality from diarrhœa takes place mostly in the third quarter of the year, and varies very closely with the mean temperature of that quarter, as is shown by the following Table:—

Period.	1852-56.	1857-61.	1862-66.	1867-71.	1872-76.	1877-81.	1882-86.	1887-91.	1892-96.
Average diarrhœa mortality per million ..	944	905	844	1111	985	761	724	581	646
Mean temperature of 3rd quarter. Departure from average of 48 years ..	-0.1°	+0.5°	-0.5°	+1.2°	+0.7°	-0.4°	-0.1°	-1.2°	+0.3°
Years above average ..	2	4	1	4	5	2	2	1	3
Years below average ..	3	1	4	1	..		3	4	2

The physical conditions conducing to the occurrence of epidemic diarrhœa, so far as known, are a porous soil impregnated with organic matter and with a water level not far below the surface, and a high ground temperature, viz., of 56° F. and upwards at a depth of 4 ft. The improper artificial feeding of infants also greatly increases their liability to the disease: it is comparatively rare for

an infant wholly fed at the breast to die of diarrhœa. Assuming the poison to be generated in the soil, the mode in which it gains access to the human body, whether by ground air, by dust, or by tainting the food, remains to be discovered. The disease is pre-eminently one of towns, and the comparatively small effect which sanitary improvements have had in reducing its mortality is, perhaps, attributable to the increasing preponderance of the urban over the rural population, and to the increased use of artificial foods of various kinds in place of breast milk in the feeding of infants.

Diphtheria first appears under a separate heading in the Registrar-General's Reports in the year 1855, though the disease had previously been known under other names, and had been prevalent in different parts of England and Wales in the early fifties. It was epidemic in 1858 and 1859, and caused a mortality in those years respectively of 339 and 517 per million: figures higher than have been since reached. After 1859, the diphtheria death-rate steadily declined to 121 per million in the five years 1867-71, and remained at that level until 1881. It then rose again to 318 in the year 1893, and has remained not far below that point in subsequent years, the mean rate during the five years 1892-6 having been 277 per million (see Chart IV). The distribution of diphtheria, as between town and country, has also varied: during the past fifteen years, from being a disease especially of the country districts it has become a disease of the towns, and more especially of London, as shown by the following Table:—

Diphtheria Death-rates per 1,000 *Inhabitants.*

Period.	England and Wales.	Great Towns.	Rest of Kingdom.	London.	Other Great Towns.
1882-86	.16	.16	.16	.23	.11
1887-91	.17	.22	.15	.32	.14
1892-96	.28	.36	.23	.60	.20

It is, as a rule, more prevalent in the south of England than in the north; and it often happens that healthy districts suffer severely from diphtheria, while unhealthy towns having a high fever, diarrhœa, and general death-rate, and a large infant mortality, may nevertheless escape diphtheria lightly. A town heretofore comparatively free

from diphtheria may develop a sustained prevalence of that disease, which may continue for several years, and then subside to its former low level.

The cause of the increased mortality from diphtheria in recent years is very obscure. There has, indeed, probably been to some extent a transference of deaths from the headings of croup and quinsy and sore throat to that of diphtheria; but the falling-off in the deaths certified from the former diseases is insufficient to account for the increase in those from the latter disease. There can be no doubt that diphtheria very frequently spreads through the agency of schools; but against the view that the compulsory school attendance established under the Elementary Education Act, 1870, is the main cause of the recent recrudescence of diphtheria, is to be set the circumstance that the increase of diphtheria only commenced about 1882, or some twelve years after education became compulsory.

We may hope that in the future bacteriology will help to solve the puzzling problems connected with this disease. Already it has thrown light on its observed behaviour, by showing that the diphtheria bacillus may be present in the fauces of a patient after apparently complete recovery, in those of a person with a sore throat not presenting the clinical features of diphtheria, and even in those of a person attending on diphtheria cases, but whose throat may appear perfectly healthy.

Scarlet fever in its clinical features is so nearly allied to diphtheria that the two diseases were grouped together by the Registrar-General until 1855, and they have sometimes even appeared to be interchangeable—at any rate, diphtheria is not unfrequently engrafted on scarlet fever—yet in their local distribution, and in the history of their prevalence since 1855, the two diseases are in strong contrast: for while diphtheria is most fatal in London and in the agricultural counties of the south and east of England, scarlet fever causes the highest mortality in the north and north-west. and especially in the densely-peopled manufacturing and mining districts of South Wales, Lancashire, the West Riding, and Durham. The causes of this difference of distribution cannot be assigned; but I may mention two conditions which I have often observed in districts which have have suffered severely from scarlet fever, and which are more general in the manufacturing and mining than in the agricultural districts, viz., (1) that the houses have behind them large common yards or back streets, which afford a meeting-place for the children of different households; and

(2) a foul condition of the ground surface about houses, from lodgment of slop-water and littering about of refuse, coupled with defective paving.

The most remarkable feature in the history of scarlet fever during the last half century has been the great diminution of its fatality in the later years of the period. In successive periods of five years, from 1847-51 to 1867-71, scarlet fever exhibited an increase of fatality (especially considering that in the earlier periods the figures for scarlet fever had included also the deaths from diphtheria), attaining its maximum in the ten years 1862-71, the highest mortality being in the years 1863, 1864, and 1870. But since then it has steadily declined, so that the average annual death-rate living, which was 1,014 per million persons in the period 1867-71, was only 188 per million in 1892-96. Moreover, while in the earlier part of the half century formidable epidemics of scarlet fever affecting the whole kingdom recurred at intervals of four, five, or six years, the later years have shown no such general epidemics: local epidemics there are still, but in any given year they affect only particular localities and not the country generally; so that the curve of scarlatinal mortality for the whole country presents a nearly uniform and steady decline, in place of the violent fluctuations which affected it during the earlier periods (see Chart IV).

The diminished mortality from scarlet fever is to be attributed to the diminished virulence rather than to the diminished prevalence of the disease. It is a matter of common observation among medical men, whose memory carries them back so far, that scarlet fever is now a comparatively mild affair, very different from the formidable disease which it was twenty-five or thirty years ago. Among cases admitted into the hospitals of the Metropolitan Asylums Board, the proportion of deaths in the five years 1872-6, was 12.5 per cent.; in 1877-81, 12.7 per cent.; in 1882-86, 10.7 per cent.; in 1887-91, 8.3 per cent.; in 1892-96, 5.6 per cent.; and in 1897, 4.07 per cent. Among cases of scarlet fever notified in London the mortality fell from 5.6 per cent. in 1890 to 3.4 per cent. in 1897; being 4.8 per cent. in the four years 1890-93, and 4.0 per cent. in the four years 1894-97. While the notifications in London fell only from 5.3 per 1,000 living in 1890-93, to 5.0 per 1,000 in 1894-97, the deaths from scarlet fever fell in greater proportion, viz., from .25 to .18. How far the milder type which scarlet fever has assumed in recent years may be due to improved sanitary conditions it is

difficult to say; but it may be noted that in recent years the disease has in some instances exhibited something of its old deadliness, when it has become epidemic in districts in which filth conditions were allowed to prevail: thus, in a Nottinghamshire colliery town, in 1893, scarlet fever caused a death-rate of 5.3 per 1,000 inhabitants; and in an epidemic in a Lincolnshire village in 1894, 10 per cent. of the notified cases were fatal.

It is doubtless owing to the recollection of its former severity that the public have a wholesome dread of scarlet fever—greater, indeed, than its present mildness might otherwise inspire—and are therefore willing to take some trouble and incur some expense in adopting measures of isolation and disinfection for the purpose of preventing its spread. It is notifiable, and it forms the great bulk of the cases treated in isolation hospitals. In London, in 1897, 67 per cent. of the notified cases of scarlet fever were isolated in the Asylums Board's hospitals, and in some towns the proportion has exceeded 90 per cent. The greatest number of deaths from scarlet fever is in the third year of life, whereas the greatest number of deaths from whooping-cough takes place in the first year, and from measles in the second year of life. But the later maximum, in the case of scarlet fever, is due to the greater liability to contract the disease in years after the first; of those who do contract it, the mortality is greatest in the first year of life, and rapidly diminishes with each succeeding year. Thus, among cases admitted into the Metropolitan Asylums Board's Hospitals in the six years 1892-97, the mortality per cent. was:—

Under 1 Yr.	1 to 2.	2 to 3.	3 to 4.	4 to 5.	5 to 10.	10 to 15.
25.8	20.4	15.2	11.3	7.4	3.0	1.2

After 15 it again rose slightly.

A postponement of the average age at which children contracted scarlet fever would therefore result in a marked reduction of the mortality therefrom, even if the prevalence of the disease were in no degree diminished, and if as large a proportion of persons eventually contracted it. In one respect scarlet fever lends itself to preventive measures, in that it usually commences suddenly with well-marked symptoms; though, on the other hand, infection is long retained, and it happens only too often that a convalescent infects others after his apparent recovery.

Measles and whooping-cough have unfortunately undergone no such diminution as scarlet fever, and at the present

time each of them causes a greater mortality than any other disease of the "zymotic" class except diarrhœa. The death-rate from measles is as high now as fifty years ago; and though that from whooping-cough has undergone a slight diminution in the past twenty years, this may be partly explained by the diminution of the birth-rate: whooping-cough being most fatal to infants in the first year of life, of whom there would be fewer with a reduced birth-rate. If we examine the statistics of a single populous city, such as London or Manchester, we find that measles is epidemic about every other year; but as the epidemics in different parts of the country are not synchronous, the curve for the whole kingdom is much more uniform: there are, however, waves of increased mortality at intervals averaging about four years, and waves of longer period, rising and falling in about twenty years (see Chart IV). The undiminished mortality from these diseases may be explained by the increased aggregation of the population in towns, which has counterbalanced the influence of improved sanitary conditions; both of these diseases being most fatal in the large urban districts. Hitherto, but little success has attended such efforts as have been made by local authorities to attack them directly: partly because of the apathy with which these diseases are popularly regarded, partly on account of their both being infectious at an early stage before the distinctive symptoms, viz., the rash and the characteristic cough, appear. Compulsory notification has been tried, but has been given up in many places where it had been adopted. Hospital isolation has been found impracticable, owing to the large number of cases for which accommodation would have to be provided, and to the tender age of many of the patients. We must hope that some day the popular conscience will be roused to consider it a duty at least to avoid exposing children to the infection of these diseases, and to take proper care of them if they should be attacked. Even more than in the case of scarlet fever, every year that a child passes without contracting measles or whooping-cough diminishes the likelihood of its dying of them; and the low mortality from these diseases among classes of society in which the patients receive proper attention, shows that the complications to which a fatal issue is generally due are largely preventable.

Small-pox, unlike the last-named diseases, is one which inspires popular dread, and consequently much attention has been devoted to its prevention, and when it occurs vigorous means are taken to stamp it out. As a

result, the mortality from this disease, in England and Wales, has greatly declined during the past fifty years, viz., from 312 per million in 1847-51, to 12 per million in 1887-91, since when it has slightly risen; but the regular decline of the disease was greatly interrupted by the formidable and world-wide epidemic of 1870-72 (see Chart V). The means which have been credited with bringing about this reduction are: 1st, the general improvement of sanitary conditions; 2nd, vaccination; and 3rd, isolation and disinfection. Without entering into the controversy which has raged around these topics, I may point out that there are statistical grounds for thinking that each of these factors has had its influence. In view of the great reduction in the prevalence of typhus, a disease spread much in the same way as small-pox, we can hardly believe that the improvement of the housing of the poor, the regulation of common lodging-houses, and the improved arrangements of vagrant wards, can have been without influence in reducing small-pox. As regards vaccination, the passing of the Compulsory Vaccination Act, in 1853, was followed for ten years by a reduced mortality from small-pox, but the disease was again epidemic in 1863-5. Improved machinery for the enforcement of vaccination was supplied by the successive Acts of 1867 and 1871. The effect of the former of these is marked by the great epidemic of 1871; but since 1871, there has been, in successive quinquennia, a steady diminution until the last, in which there has been a slight rise, concurrently with the growing proportion of children who escape vaccination, and the increase of inefficiently-performed private vaccinations. To the alteration in the age-incidence of small-pox since vaccination came into vogue I need only allude. It is only during comparatively recent years that hospital isolation of small-pox cases has been systematically practised. In earlier years, hospitals were built or extemporised on the occasion of an epidemic, but were rarely kept in readiness for the isolation of the early cases. Even now, their provision is the exception rather than the rule, except in the larger towns. In London, the hospitals of the Metropolitan Asylums' Board have been available for small-pox since 1870; but nevertheless, the mortality from small-pox remained high. It was proved by the investigations of our Jenner Medallist, Mr. Power, that the small-pox hospitals within the confines of the Metropolis formed foci for the dissemination of the disease around them; and in 1886 these hospitals were closed for small-pox, cases of that disease being taken down the river to

hospitals outside the area of London. Since then, the death-rate from small-pox in London (the deaths among cases so removed being included) has undergone a marked diminution, as shown by the following figures :—

	1870-75.	1876-80.	1881-85.	1886-90.	1891-95.
Small-pox death-rate per million living ...	604	310	287	2	16

(see also Chart VI).

The principal agents by which small-pox is spread at the present time are tramps and unrecognised cases. Unfortunately, while vaccination has caused many cases of small-pox to be of a mild and modified form, less readily recognisable than the typical disease, isolation of small-pox has deprived many medical men of the opportunity of becoming familiar with it; and thus it occasionally happens that the nature of a case of small-pox is overlooked until the mischief is done. Outbreaks of small-pox also occasionally occur among sorters of rags at paper mills: the infection of small-pox being especially persistent, and attaching itself readily to textile articles.

Influenza, which, as a registered cause of death after the epidemic of 1847-48, gradually declined almost to extinction, has, since its return in the winter of 1889-90, become one of our most formidable epidemic diseases, having caused in the quinquennium 1892-96 a mortality of 326 per million: greater than that in any preceding quinquennium, and less among epidemic diseases only than the death-tolls from diarrhœa, measles, and whooping-cough; while, unlike these diseases, its victims are, largely, persons of ages when their life is of most immediate value to the community (see Chart V). The mortality from influenza, though considerable every year since its return in 1889, has, however, steadily declined since 1891, with the exception only of 1895, and its behaviour has changed. Instead of the rapid spread, abrupt culmination, and speedy decline to almost complete disappearance which marked the earlier epidemics, the later ones have become more protracted, and the disappearance in the intervals less complete; in fact, influenza has taken on the character of an endemic disease with seasonal increase in the winter months. I fear that we must admit that influenza remains an opprobrium to preventive, if not to curative, medicine, and it seems likely to do so until its pathology is better known. It is, I believe, now generally accepted that the disease is propagated from person to person, and that Pfeiffer's bacillus is its essential cause; but the crux is to determine

what the factor or factors may be, under the influence of which it from time to time assumes such a remarkable increase of virulence—often nearly at the same time in distant and dissimilar parts of the world. In order to carry the investigation of influenza further, the chief requisite appears to be some method, such as we have for enteric fever or diphtheria, of identifying the true disease and discriminating between it and the ordinary catarrhal affections which resemble it, and are often called by the same name.

The last disease which I shall notice is Phthisis. From this disease (formerly so dreaded on account of its supposed incurability and inevitable heredity), the mortality has steadily declined in each succeeding quinquennium, until it is now less than half what it was fifty years ago. In the period 1847-51, the death-rate from phthisis per million living was 2,872, and in 1892-96 it had fallen to 1,405 (see Chart V). Other tubercular and scrofulous diseases have also declined, but the comparison with earlier periods is somewhat affected by changes in classification. As I have already remarked, the pioneers of sanitary reform in the early forties recognised the influence of unsanitary conditions in promoting the endemic prevalence of consumption, and its decline is doubtless largely attributable to the general improvement which has taken place in the conditions of lodgment of the people: such as the closing of cellar dwellings, the repression of overcrowding, the proper provision of ventilation of houses and air space about them, and the ventilation and abatement of dust in factories. The late Sir G. Buchanan also showed that a considerable abatement of phthisis mortality followed works of sewerage and drainage, where these had the result of lowering the level of the subsoil water. Light has been thrown upon the mode in which such circumstances affect the prevalence of phthisis by the observations of Dr. Ransome and others. that the bacillus tuberculosis long retains its vitality in dark, damp, dirty places, but soon perishes if exposed to light and air. Attention is now being paid to the question of direct attempts to prevent the spread of tubercular diseases by disinfection of the sputa of consumptive patients, and by preventing the sale of milk yielded by cows affected with tuberculosis, and of the flesh of tuberculous animals.

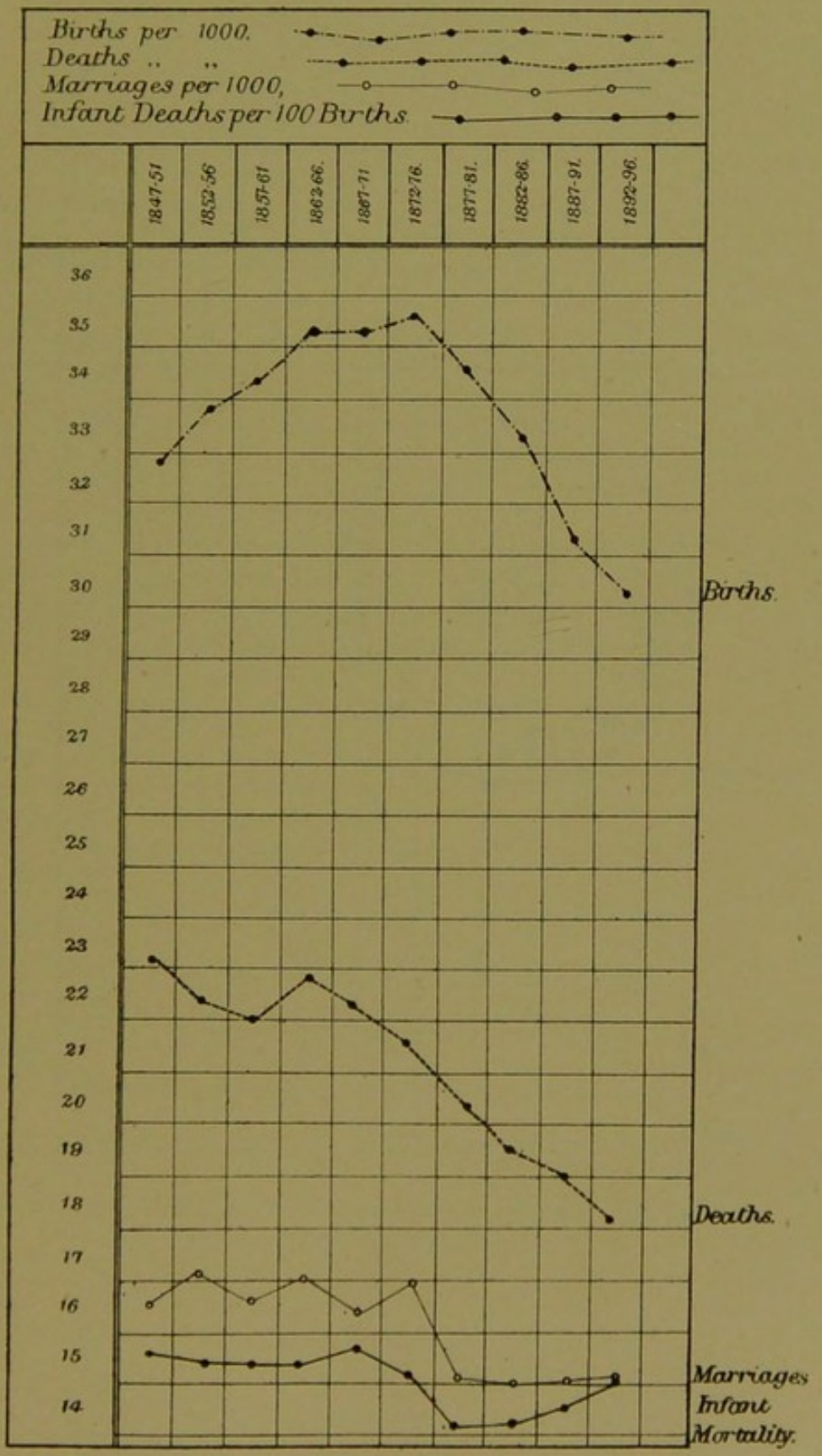
In conclusion, we may observe that for the production of an epidemic of any disease, the concurrence of three factors or groups of factors is necessary. There must be, first, the

presence of the specific contagium; secondly, a favourable environment in the form of appropriate conditions meteorological, topographical, social, or sanitary; and thirdly, personal predisposition on the part of those who are exposed. The environment may act by affording facilities for bringing the contagium into relation with its victims, as a polluted water supply affords opportunity for the spread of cholera and enteric fever; by enhancing the virulence of the contagium, as appears to happen from time to time with influenza; or by lessening the powers of resistance of the persons exposed to it, as famine predisposes a community to typhus.

In our efforts to prevent the spread of epidemic diseases we may consequently aim to counteract one or other of these three factors. We may seek to exclude the contagium, as was formerly attempted by quarantine, to remove it by isolating the patient, or to destroy it by disinfection. The veterinarian has a still more drastic method which we cannot employ. We may seek, by improving the sanitary state of a locality, to remove the conditions which favour the propagation of disease, a method which has borne such good fruit in the case of cholera and enteric fever; or, thirdly, we may seek to render the persons who may be exposed to infection proof against the disease: a method which has been long in use in the instance of inoculation and vaccination against small-pox, and has recently been practised, in one mode or another, against other diseases, as plague, enteric fever, and cholera.

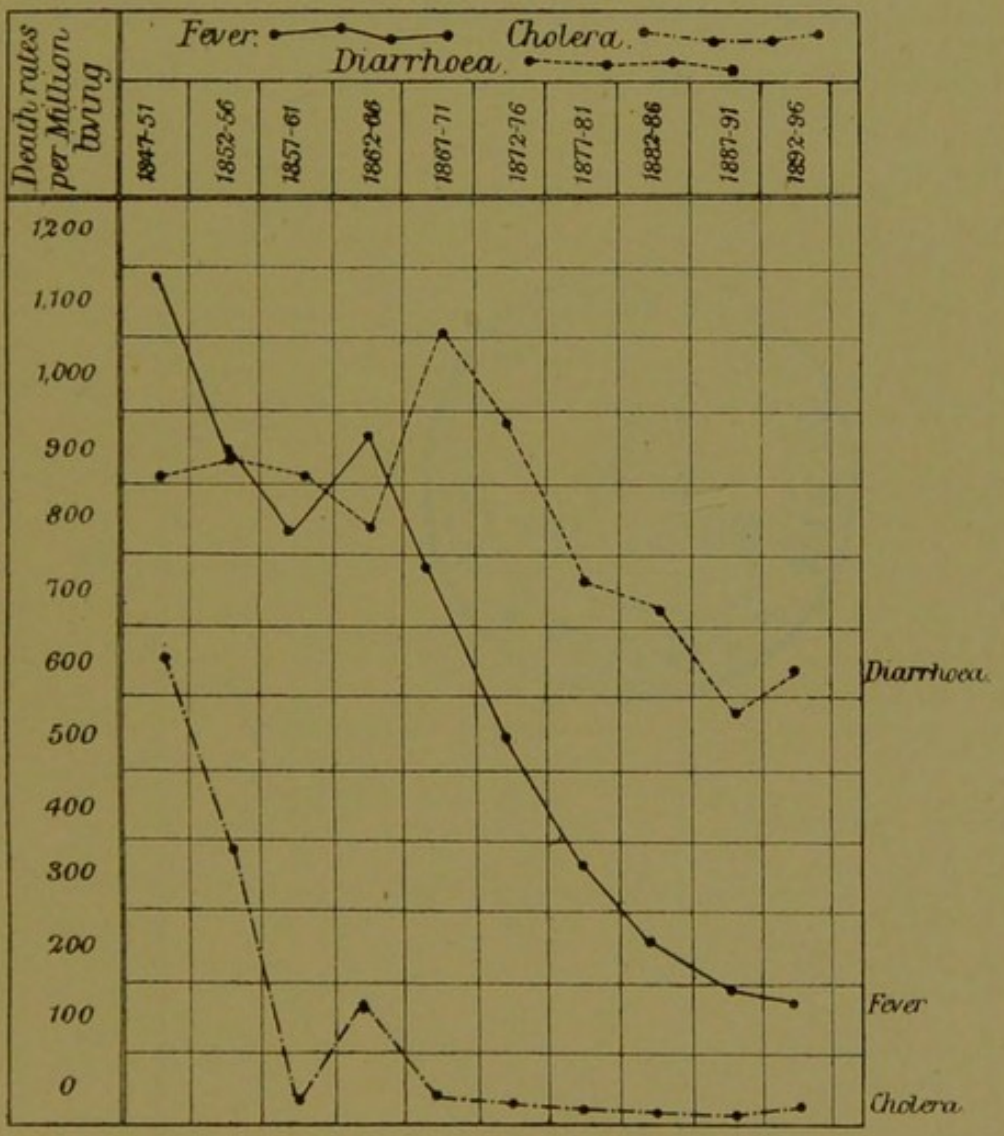
Our efforts for the prevention of epidemic diseases will achieve success in proportion as the natural history and causes of these diseases are known; as the practical means by which these causes can be removed or counteracted have been designed and perfected; and as public opinion has been educated to see the need of making use of these means. The first of these functions, viz., that of elucidating the behaviour and causes of epidemic diseases, is the one which appertains to our Society; and it only remains for me, in thanking you for the patience with which you have listened to this Address, to express the hope that our labours during the session upon which we have entered may be fruitful to this end.

CHART I. ENGLAND AND WALES, 1847-96.



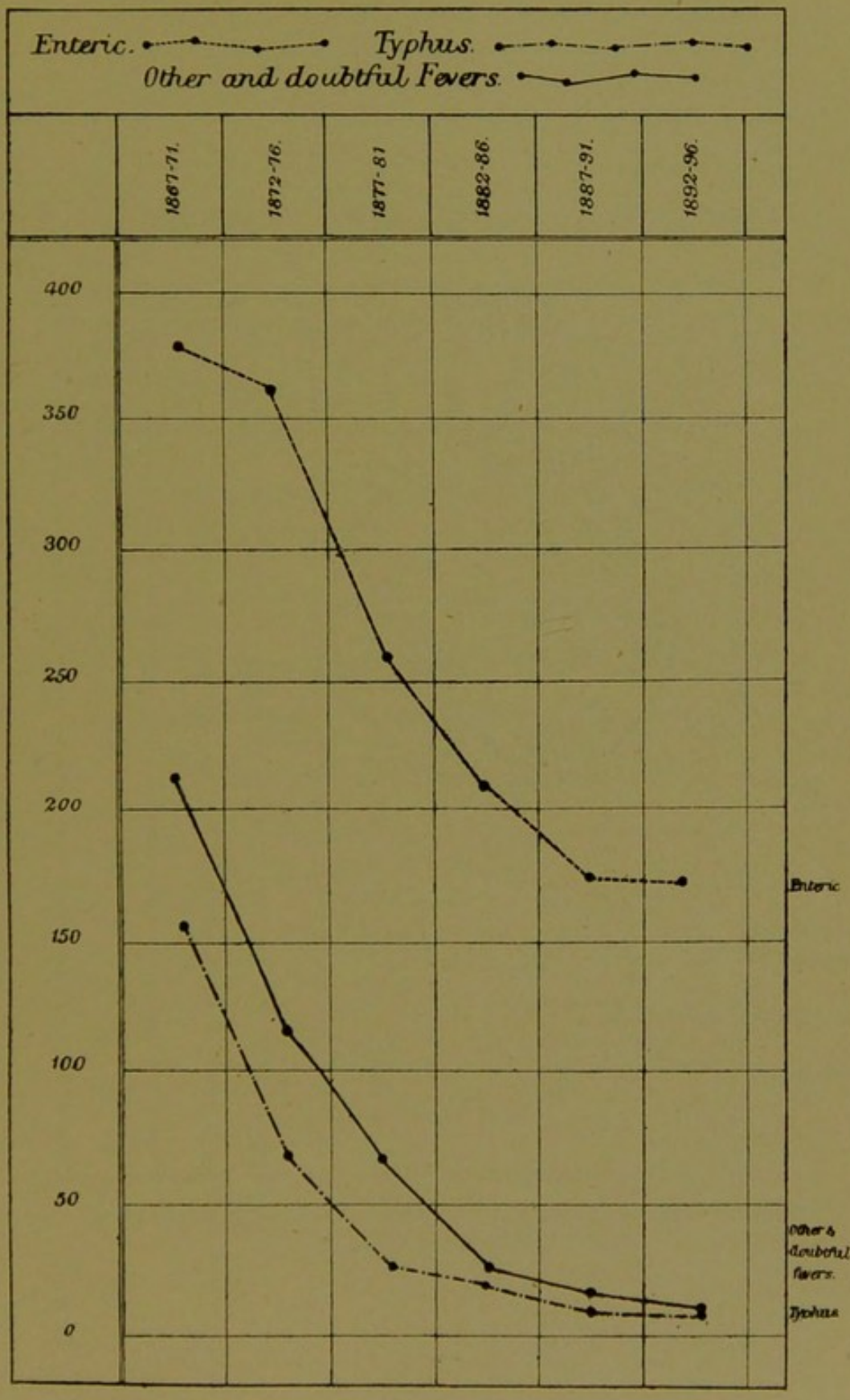
Birth, Death, and Marriage Rates per 1,000 Inhabitants and Infant Mortality in Successive Quinquennia.

CHART II. ENGLAND AND WALES, 1847-96.



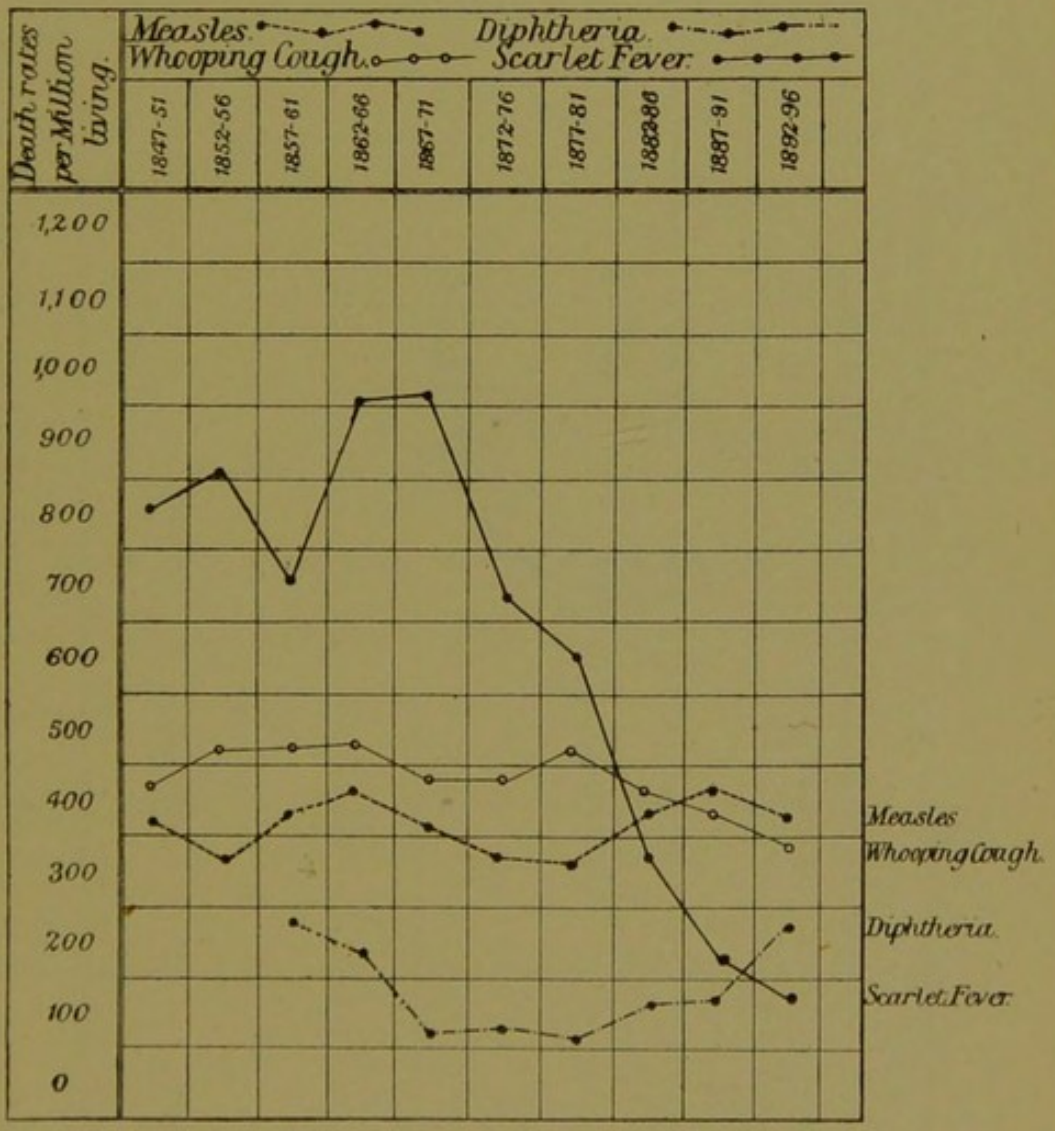
Death Rates per 1,000,000 Inhabitants in Successive Quinquennia from Fever, Cholera, and Diarrhœa.

Chart III. England and Wales, 1867-96.



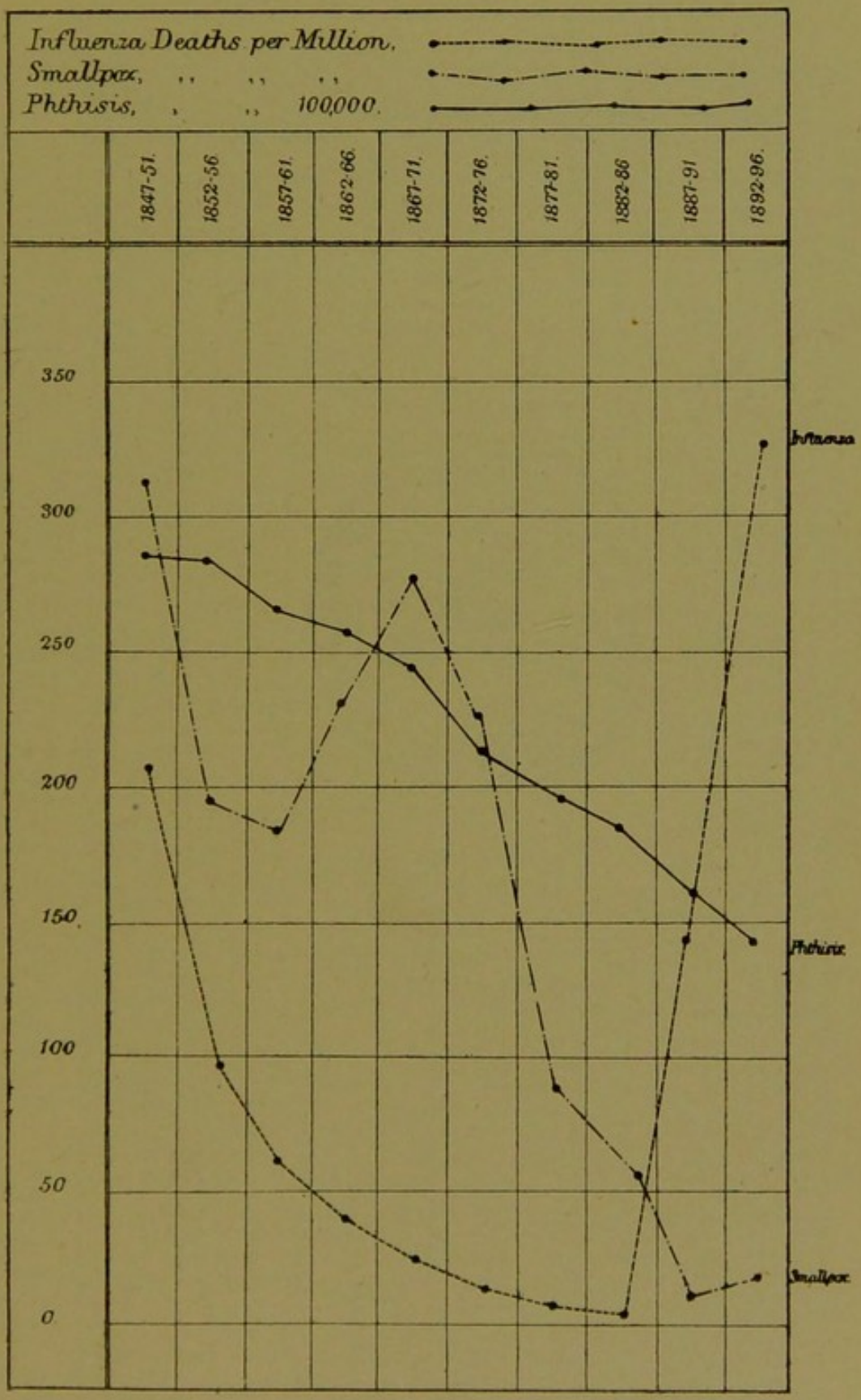
Death Rates per 1,000,000 Inhabitants in Successive Quinquennia from Typhus, Enteric, and Other continued Fevers.

Chart IV. England and Wales, 1847-96.



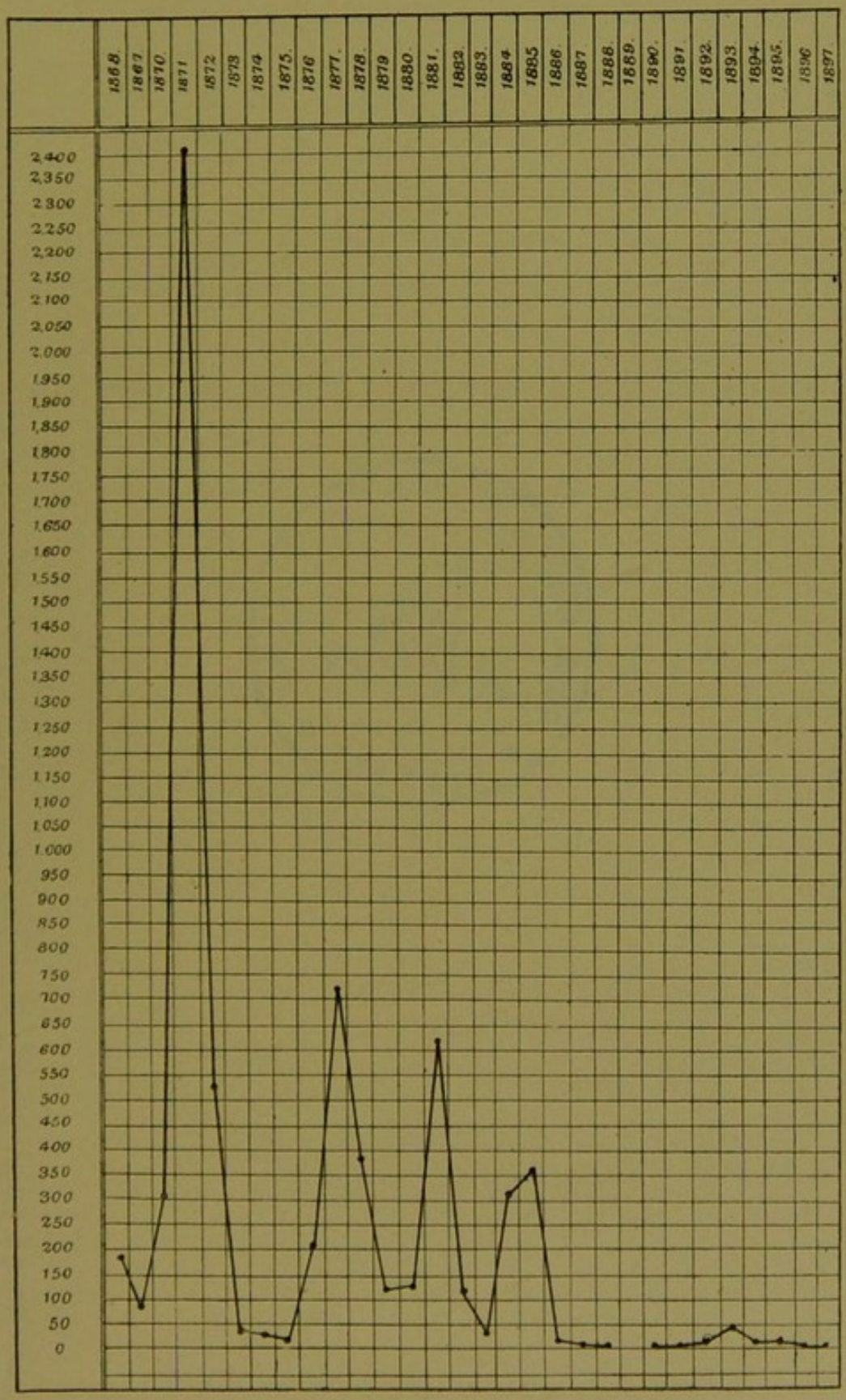
Death Rates in Successive Quinquennia from Diphtheria, Scarlet Fever, Measles and Whooping-Cough.

Chart V. England and Wales, 1847-96.



Death Rates per 1,000,000 Living from Small-pox and Influenza, and Death Rate per 100,000 Living from Phthisis.

Chart VI. London, 1868-94.



Death Rates per 1,000,000 Inhabitants from Small-pox in each Year.