

EPIDEMIOLOGY DURING THE 19TH CENTURY

Epidemiology, Statistics, and Public Health in the Victorian Britain, 1837-1902

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Abstract

The modern history of statistics and epidemiology emerged in nineteenth-century England, following the introduction of demographic measures and concerns about public health in the years before 1850. This paper traces these developments and their consequences across the later nineteenth century, which were reflected in sharply falling death rates by 1900-1920.

Keywords : *census, epidemiology, public health reform, Britain, history of the 19th century.*

Résumé

Épidémiologie, statistique et santé publique dans l'Angleterre Victorienne, 1837-1902

L'histoire contemporaine de la statistique et de l'épidémiologie est apparue en Angleterre au XIX^e siècle, à la suite de l'introduction de mesures démographiques et du poids croissants des enjeux de santé publique dans les années précédant 1850. Le présent article retrace ses développements et leurs conséquences à la fin du XIX^e siècle, qui se traduisirent par une forte baisse des taux de mortalité entre 1900 et 1920.

Mots-clés : recensement, épidémiologie, réforme de la santé publique, Grande-Bretagne, histoire du XIX^e siècle.

In 1973, the American academic Peter Stansky edited a book entitled *The Victorian Revolution: Government and Society in Victoria's Britain*, and since then, the concept of the Victorian revolution in government has been explored in numerous ways¹. Stansky's volume covered political parties, education, high farming, the Civil Service and the intelligentsia, but made no mention of public health, local government, or statistics. Yet an important part of this profound revolution in Britain's style of government lay in the introduction of measures designed to control rapidly deteriorating urban and rural environments, and the declining quality of life and health of a rapidly increasing urban population. The tools for measuring these developments had been put in place before Victoria ascended the throne, and played a crucial part in stimulating the wide-reaching social reforms which became so characteristic of the Victorian era. The year 1801, saw the introduction of the first population census, to be repeated every ten years into the future, but it was not until 1837, the year Victoria came to the throne, that Civil Registration, the official recording of all births, marriages, deaths, and, importantly, causes of death, also became law.

The Victorian Revolution in the government of public health

The importance of the census and civil registration

These two tools for the measurement of population, the census and civil registration, made three things clear by 1851: that the size of the population of England and Wales had doubled since 1801, that population growth was most rapid in the industrial cities and in London, and that the principal causes of high death rates and premature deaths in these cities were infant mortality, and crowd diseases – smallpox, the childhood infections, fevers, diarrhoea, and tuberculosis. Already in 1839, the Health of the Towns Association had been established to try to combat some of these problems, and in 1850 the Epidemiological Society of London was created to study the problem of disease. English sanitarians were already studying European manifestations of cholera with interest, since the movement of the disease across the continent appeared to follow trade routes and lines of communication². In 1832, 1848 and 1854, epidemic cholera at Hamburg was rapidly followed by the appearance of the disease in seaports on the east coast of England³. Meanwhile the accumulating evidence of the annually published cause-of-death statistics suggested that unsavoury environmental conditions were responsible for excess and premature deaths in British towns and cities. It was Edwin Chadwick's concern for the economic consequences of these premature deaths that led to the

¹ Stansky P. ed. *The Victorian Revolution: Government and Society in Victoria's Britain*. New York : NewViewpoints (sic), 1973.

² Hauser P. *Le choléra en Europe depuis son origine jusqu'à nos jours*. Paris: Société d'éditions scientifiques, 1897: 533.

³ Cowper W. Precautionary advice to Local Boards of Health, with reference to Epidemic Cholera. *The Lancet*, 1857, II: 374-75.

publication of his landmark *Report on the Sanitary Condition of the Labouring Classes of Great Britain* in 1842⁴.

Chadwick's publication, although it is commonly agreed that it sparked the Victorian public health revolution, was not its only driver. The real spur to these highly important local government reforms was statistical cause-of-death information on cholera. Cholera visited England in 1832, 1848, 1854, and to a much lesser degree in 1866. The 1854 cholera outbreak was the occasion of a classic moment in Victorian public health history, when John Snow identified the source of a local cholera outbreak in Soho, as drinking water taken from the Broad Street pump. The local death records showed cholera deaths clustered in the streets about the pump, but the positive proof lay in a single solitary cholera death registered in the wealthy northern district of Hampstead on the furthest fringe of the city. The victim was a woman who liked the taste of the Broad Street water so much that she had a flask sent up to her house every day⁵. It was this statistical outlier that – in the age before bacteriology – proved the case against the Broad Street pump.

Local Government and the national organisation of public health

It is not too extreme to say that the episode of the Broad Street pump began the British public health revolution. Although the City of London – London's world-famous financial district – had taken the innovative step of appointing a Medical Officer of Health in 1848, to supervise and improve sanitary arrangements and living conditions within its bounds with a view to reducing or controlling disease outbreaks, no other London authority had followed its example. But London was too important to be left at the mercy of epidemic disease, and in 1855 Parliament passed the Metropolis Local Management Act, effective from the beginning of 1856. Under this legislation, London was divided up into 25 districts, governed by rate-payer elected civil vestries, and each was required to appoint a Medical Officer of Health with sanitary inspectors in support, to improve sanitary conditions and to monitor, prevent or contain, outbreaks of infectious disease⁶. Cause of death information initially provided the knowledge base for these operations, but in 1889 the Infectious Diseases Notification Act considerably widened and improved that base by making notification of cases of the principal infectious diseases compulsory on doctors over the whole country. The system of public health management imposed on London in 1855 was extended to the whole of England and Wales in 1872. This national organisation consisted in urban and rural district councils, each of which was obliged to appoint a Medical Officer of Health with appropriate staff, as had been done in London. In 1889 a further organisational tier, independent of local government, was added at County level.

The 1872 Public Health Act did not merely establish a system of government responsible for managing local public health issues across England and Wales, it also created a Central Medical Department, under the newly established Local Government Board. This department was headed by the Chief Medical Officer, with a supporting staff of medical inspectors and a suitable secretariat. The Department's annual reports, including accounts of investigations undertaken by individual medical inspectors, were published annually among the Official (Parliamentary) Papers issued by successive governments. These investigations brought a new level of connectedness into epidemiological investigation in England and Wales. With information garnered country-wide from

⁴ Chadwick E. *Report on the Sanitary Condition of the Labouring Population of Great Britain*. Flinn M W ed. Edinburgh: Edinburgh University Press, 1965.

⁵ Snow J. *On the Mode of Communication of Cholera*. London: John Churchill, New Burlington Street, 1855, 2^d ed.

⁶ Hardy A. Public health and the expert: The London Medical Officers of Health, 1856-1900. In Mcleod R M ed. *Government and Expertise: Specialists, Administrators and Professionals, 1860-1919*. Cambridge: Cambridge University Press, 1998: 128-42.

registrars of deaths, from the weekly record of notifications of infectious disease (from 1889), and from local medical officers of health, the staff of the Central Medical Department travelled country-wide to investigate complex or puzzling disease incidents and occurrences, often involving more than one geographical area.

Investigating diseases

Searching for the source of infection on the ground

One such report, dating from 1890, provides an example of the quality and style of these investigations⁷. By the 1890s, cholera, typhoid and diarrhoea were known to be, mostly, caused by drinking water contaminated by human excrement containing the bacteria which caused these diseases. The 1890 report was concerned with the drinking water supply of County Durham, in the north-east of England, where the statistics indicated that an outbreak of typhoid had occurred over a wide area north and south of the River Tees in the six weeks from 7 September to 18 October. Since the river supplied the local drinking water, it was assumed that the river water was the source of infection, and in November Medical Inspector Frederick William Barry was sent from London to investigate. He started out from the market town of Darlington, to follow the course of the Tees towards its source. On his journey, during which he crossed and re-crossed the river, he explored numerous hamlets, villages, and farmsteads before reaching the pretty market town of Barnard Castle. Barnard Castle lies on the Durham side of the river, facing the villages of High and Low Stainsforth on the Yorkshire side. The area was already popular with holiday makers during the summer months, but Barry's eyes were not for the grandeur of the scenery. His mission was to discover the extent to which this natural environment was polluted by human sewage. As he tracked the drainage condition of houses, farms, and settlements, and the fall of drains, sewers, and open ditches into the river, his concern mounted. On reaching Barnard Castle, he was appalled to find that all sewage conduits emptied their contents into the river, and that layers of solid sewage lay deep on the foreshore. Never in his whole career, Barry noted, had he seen 'such a mass of stinking abominations' as lay alongside the Tees at Barnard Castle at the time of his visit.

Using statistics and census data

Barry's rural excursion was not unusual for a Medical Inspector. Sanitary improvements had considerably reduced typhoid incidence in urban areas by the 1890s, and public health investigators were increasingly paying attention to rural conditions as the source of urban pollution and disease. The typhoid outbreak which Barry was investigating occurred over ten Durham registration districts, but before he finished work, the area was hit by a second outbreak, which lasted from 28 December 1890 until 7 February 1891. Some 3,000 cases were reported to have occurred in the combined outbreaks. As a result of the second outbreak, Barry's report on the earlier epidemic was delayed, and he was able to make use of the 1891 population census data in constructing his final analysis. His conclusions were stark: pollution of the Tees, aggravated by heavy rainfall and flooding, which had washed the filthy foreshores clean, and the consumption of the polluted Tees water by local residents, had generated both outbreaks. During those two epidemic periods, fifteen typhoid cases had occurred among Tees water drinkers for every one among those who did not drink Tees water.

⁷ The following account of Barry's investigation is taken from Hardy A. *Salmonella Infections, Networks of Knowledge and Public Health in Britain, 1880-1975*. Oxford: Oxford University Press, 2015: 21-3.

The heyday of observational epidemiology at the turn of the century

The evidence for Barry's indictment of the Tees water supply was circumstantial, but was none the less accepted by his contemporaries. The investigation was a classic of late Victorian observational epidemiology: a broad and detailed survey of the terrain in which the unusual typhoid outbreak had occurred. Barry gave a detailed statistical analysis of the outbreaks and of their incidence in the ten registration districts involved. The sanitary circumstances of the districts were described in detail (their geographical size, population size, occupational and class structure, number of houses with their rateable value and sanitary condition, the state of the roads, the nature of the local economy and the distribution of disease), and the local arrangements for the disposal of human excrement and refuse carefully recorded. Drinking water received particular attention: it was for this purpose that Barry undertook his up-river journey towards the source of the Tees. He gave the history of the local corporation water undertakings since 1870 in full, concluding that their deficiencies were responsible for the outbreaks.

Barry's 1890 excursion to Durham illustrates very neatly the use which late Victorian epidemiologists made of statistics. Registered deaths and causes of death informed local authorities that an epidemic was in progress. In a difficult case, or where, as in Durham, several local authority areas were involved, appeal would be made to the Medical Department at the Local Government Board for an experienced epidemiologist to investigate the problem. Taking into account the scale of the problem and the nature of the disease involved, an appropriate investigation would follow – with typhoid, as here, by tracking the water sources back from the site or location of the epidemic to origin, to identify the pollution access point and the source of that pollution. In all these investigations, whatever the disease involved, statistics recording cases and deaths from a particular disease in a particular local population provided the key outbreak identification data⁸. In the 1890s, this method of investigation was in its heyday. By the early 1900s, the new science of bacteriology was beginning to come between the statistics and the epidemiology⁹.

None the less, the purely statistical investigative epidemiology of the Victorian period proved extremely effective in resolving local public health problems as they related to infectious diseases. The statistics provided the momentum for compulsory infant vaccination against smallpox, begun in 1851, for the establishment from 1867 of isolation hospitals for cases of infectious disease, and in 1870 for the construction of the network of port sanitary authorities, to police the sanitary condition of shipping, and to prevent the import of dangerous infection diseases from abroad. All these measures were inspired by the information base, both statistical and geographical, which cause-of-death information provided¹⁰. From that database, the whole programme of preventive action was built up over the period between 1855 and 1900. By the end of Victoria's reign Britain's preventive structure encompassed administrative, environmental and legal provisions, and its effectiveness was demonstrated by falling death rates. Crude death rates for England and Wales stood at 22.4 per thousand living in the decade 1841-50, by 1891-1900 they stood at 18.2, and by 1911-20 at 14.0. If the real momentum of improvement in the people's health did not show itself until the first two

⁸ These reports are contained in *British Parliamentary Papers: Reports of the Medical Officer to the Privy Council, 1859-1870* ; *Reports of the Medical Officer to the Local Government Board, 1872-1902*.

⁹ Hardy A. On the Cusp: Epidemiology and Bacteriology at the Local Government Board, 1890-1905. *Medical History*, 1988, 42: 328-34.

¹⁰ For this information, consult the annual and decennial reports of the Registrar-General for England and Wales, available in the published *British Parliamentary Papers series*.

decades of the twentieth century, it was the statistically and epidemiologically driven public health measures put in place during Victoria's reign that brought about that dramatic demographic achievement.

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