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The urban sanitary movement in England and Germany, 1838–1914: a comparison

E. P. HENNOCK*

This article deals with an important aspect of public health policy in the two leading industrializing countries of Europe. Both had a substantial number of large towns in this period, despite the fact that German industrialization had only just begun in 1859 (see Table 1). It is a companion piece to a comparative study of vaccination policy published in 1998,[1] and is intended to be complemented by a study of the impact of bacteriology on public health. It is for that reason that little attention is paid to bacteriology here.[2] The first study dealt with the concept of medical police; it was about modes of compulsion. This one is about the provision of a sanitary infrastructure of central water supply, sewerage and sewage treatment. It deals not so much with the ordering of people as with the making of things.

It is a study of Germany and of England and Wales, not of Great Britain. Although the sanitary movement was a British phenomenon, the administrative structures were different in Scotland and so were the statistical series. The other side of the comparison raises even more complex issues, particularly since this investigation straddles the years of the founding of the German Empire. I have drawn my examples from across the territory of the German Empire of 1871 and have paid some attention to events in Bavaria, but my focus is primarily on Prussia. Since public health policies remained the responsibility of the individual German states even after 1871, this concentration on the largest of them makes sense.

*School of History, University of Liverpool.

TABLE 1
Numbers of large towns in England and Wales and in Germany, 1851–1911[a]

	Population 50,000–100,000	*Population over 100,000*
England & Wales 1851	15	9
Germany 1850[b]	10	4
England & Wales 1871	21	13
German Empire 1875	21	12
England & Wales 1911	54	44
German Empire 1910	52	48

[a] Census of England and Wales 1851, vol. I, pt I, cxxvi–vii; 1871, vol. IV, 32; 1911, Preliminary Report, ix; J. Reulecke, *Geschichte der Urbanisierung in Deutschland* (Frankfurt, 1985), Table 3; *Statistisches Jahrbuch für das Deutsche Reich*, vol. 2 (1881), 3–5; vol. 35 (1914), 4–5, 12–13.
[b] The territory of the Empire created in 1871.

While there have been some publications which present self-contained studies of the history of public health in several countries, including England and Germany, the number of explicitly comparative studies is few, if we exclude demographic history at a high level of abstraction. In the 1860s an ambitious comparative survey of state administration by Lorenz Stein included a volume on public health but it has found no imitators.[3] The studies of English policy with a comparative look at Germany that followed in the 1870s were part of the propaganda put out by the German sanitary reformers. Thereafter interest flagged, to be revived only quite recently.[4]

I

We begin with the English sanitary movement, for it preceded anything comparable in Germany. The impetus had come from the Central Poor Law Commission in 1838, itself established less than four years earlier. The investigations commissioned by Chadwick in 1838 were deliberately directed towards the 'physical causes of fever in the Metropolis which might be prevented by proper sanitary measures', to quote from the title of the report by Drs Arnott and Kay. This exclusive concern with sanitary measures also characterized Dr Southwood Smith's report, *On some of the physical causes of sickness … which are capable of removal by sanitary measures* and Chadwick's subsequent *Report on the sanitary condition of the labouring population of Great Britain* of 1842. It owed something to the discovery that Boards of Guardians lacked the powers to remove nuisances, powers that their predecessors in the parish had possessed, but

it should be understood primarily as an attempt to divert attention from other causes of sickness among the poor that were not physical, that is they arose from debility caused by low income and overwork.

There is no paradox here. The Poor Law policy of providing support less eligible than the situation of the independent labourer of the lowest class was based on the assumption that the normal standard of life of the lowest class of labourer was adequate to maintain health. An exception was allowed in the case of the sick, who could be relieved in their homes, and on the recommendation of the medical officer provided not only with drugs but with other so-called 'necessaries', or necessities as we would now say. In practice these 'necessaries' often took the form of food and fuel, of mutton broth and sustaining porter or port. Indeed, medical officers, who had to pay for drugs from their salary, had an incentive to put the emphasis on building up a patient's constitution by means of 'necessaries', for which the Guardians had to foot the bill. Too great an emphasis on debility as a cause of sickness could, however, undermine the whole strategy of the New Poor Law. Paupers of working age had to be assumed to be either able-bodied or sick, and the numbers of the latter kept to a minimum: hence the importance of focusing on the 'physical causes of sickness' and of locating the 'exciting cause' of sickness in the poisonous 'miasma' given off by decaying organic matter.

Christopher Hamlin has recently demonstrated the lengths to which Chadwick went to suppress medical views that did not place the primary emphasis on physical causes of disease. Hamlin interprets this as a remarkably successful attempt to deal with critics of the Poor Law who accused it of ignoring inadequate income and harsh working conditions as causes of the debility that could lead to sickness, and indeed of directly producing such debility through its deterrent measures. In his own words, 'the sanitary initiative was so important to the [Poor Law] commission because it was an alternative to the claim that destitution caused disease'. By contrasting the broad range of contemporary medical opinion on the causes of disease with Chadwick's exclusive emphasis on physical and structural causes, Hamlin claims convincingly that 'within a decade public health had become something quite different from what it had been in the mid-thirties'.[5]

He identifies two successive processes that led to this change. The first culminated in the Report of 1842 on *The sanitary condition of the labouring population of Great Britain* and was a dispute with medical opinion over the causes of disease in the labouring population. It was in fact a dispute over the nature of the policy agenda. The second process was clinched by the Royal Commission on the Health of Towns (1844–1845), which had tacitly accepted Chadwick's agenda. What is

more, by switching the focus of attention from the condition of the labouring population to the health of towns the Royal Commission distanced the enquiry from what he calls the 'messy social and moral issues' that had been prominent in the Report of 1842. It now appealed to the middle-class municipal improvers, whose efforts had previously been little concerned with the state of the masses but on the contrary with that of the streets in which they themselves lived and worked. 'In this way', Hamlin writes, 'an easily justifiable and relatively uncontentious restriction in the scope of a single inquiry shifted the focus of public health to municipal engineering and local government.' In that form 'sanitation would become a popular social movement – it seemed simple, promising, unequivocally good. Almost any reformer could find a reason for being a sanitary reformer too.' 'The recommendations of the Royal Commission', he adds, 'broadly speaking outlined the framework of public health legislation in Britain for the next half-century.'[6]

That sanitary programme consisted first and foremost of the construction of a main sewerage system, to which dwelling-houses were to be connected, of street-paving, the closing of surface wells polluted by faeces and the provision of a supply of water suitable for household use and for the flushing of the sewers. In its most ambitious and systematic Chadwickian form it also required the removal of faeces via the sewers by means of water carriage and its application to agricultural land on the outskirts of the town. In practice, however, towns that constructed a main sewerage system in the early stage of the sanitary movement poured its contents into a local river, thereby adding to the problem of water supply for populations living further downstream and provoking riparian landowners to seek legal redress.[7]

The sanitary movement thus represented a narrowing or focusing of attention, compared with earlier views. Its relative simplicity gave it a cutting edge, very effective for propaganda and action. Not merely was inadequate diet taken off the agenda, but also the inability of workers to pay a higher rent for the improvement of their dwellings. Much of the sanitary improvement was to be external to the actual dwellings and financed from the rates, that is by the community as a whole. Working conditions in factories, which had also drawn criticism in the previous few years, were to become the province of a separate body of legislation and administration with its own strictly limited brief.

II

The English movement was launched on a wave of publicity that was not confined to Great Britain. An international congress on hygiene held in Brussels in 1852 gave the British sanitarians an opportunity to make their views known, one which they were quick to seize.[8]

In Germany, where British engineers had already been active, constructing gas and water works for private companies, the best-known reaction was that of Hamburg. After a serious fire in 1842 the authorities commissioned William Lindley, a British engineer working in Germany, to provide a public water supply. That was in response to the danger of fire rather than disease and was in no sense typical of German towns. Under Lindley's influence Hamburg also decided to seize the opportunity offered by the necessary reconstruction of so much of the city to construct a central sewerage system. It came into operation in 1853.[9]

Such an active interest in matters of public health contemporary with developments in England was unique. The nearest instance to it was in Frankfurt, which at the time was, like Hamburg, an independent city-state within the German Confederation. The technical advice was again Lindley's, but the driving force behind the sanitary movement came from Georg Varrentrapp, a local physician, who had visited England in 1847 and 1852 and was familiar with the sanitary movement there. The pros and cons of main drainage were debated in the city council throughout the latter half of the 1850s, and after setting up a commission of experts in 1863 the city authorities sanctioned the construction of a small-bore water-flushed main drainage system on the English model. After some further delay, caused by the annexation of the city by Prussia, the system was in use by 1868.[10]

Matters were less advanced in Berlin, where in the 1850s the death-rate had been 27 per thousand. After visits by officials to London, Hamburg and Paris, projects for a main drainage system were under discussion throughout the 1860s while the decennial death-rate rose to 32. Nothing was actually done until 1873, by which time the death-rate had risen even higher.[11]

These initiatives in a few exceptionally privileged cities did not lead to more general concern with the effects of the urban environment on health until after the cholera epidemic of 1866. Compared with Britain the 1850s and early 1860s proved surprisingly barren.[12]

The demographic consequences of this contrast are suggested by the crude death-rates of the ten largest towns in England and Germany provided by Jörg Vögele.[13] Table 2 shows that Hamburg resembled Liverpool and Manchester in that a particularly high crude death-rate in

TABLE 2
Crude death-rates per thousand in the ten largest German and English towns, 1841–1910

	1841–50	1851–60	1861–70	1871–80	1881–90	1891–1900	1901–10
Germany							
Berlin	25	25	30	31	25	19	16
Breslau	33	35[a]	37[a]	34[b]	30	26	22
Cologne	29	28[a]	30[a]	30[b]	27	24	19
Dresden	29	28	28	26	24	20	16
Düsseldorf	23[c]	24	28	28	23	21	16
Frankfurt	19	17	19	19	20	17	15
Hamburg	31	27	26	26	26	21	16
Leipzig	28	24	25	25	22	21	16
Munich	32[a]	36	38	38	30	25	19
Nuremberg	27[d]	n/a	32	26[e]	27	23	19
England							
Birmingham	25	25	25	25	20	21	17
Bristol	n/a	24	24	24	19	18	12
Bolton	27	27	26	26	21	20	16
Bradford	25	26	26	26	21	19	16
Leeds	28	28	29	29	23	21	17
Liverpool	34	27	31	31	24	23	19
London	n/a	24	25	25	20	19	15
Manchester	32	28	29	29	24	23	19
Newcastle	27	27	27	27	22	20	17
Sheffield	26	27	27	27	22	20	17

[a] Includes still-births.
[b] Includes still-births for some years in this decade.
[c] 1846 and 1850 only.
[d] n/a indicates that figures are not available.
[e] 1877–1880.
Source: J. Vögele, *Urban mortality change in England and Germany, 1870–1913* (Liverpool, 1998), 37.

the 1840s was reduced in the 1850s and it resembled all the English towns in that this remained fairly level over the next decades. In England it began to decline in the 1880s. In Hamburg, where sanitary reform stagnated, it declined only in the 1890s after the sanitary shake-up following the cholera epidemic of 1892.[14] The English towns display a fairly similar pattern, but the crude death-rate of the German towns shows much diversity. Berlin, Düsseldorf and Munich show them rising markedly until the 1880s, Breslau until the 1870s, Cologne and Frankfurt rising rather less, Nuremberg level except for a peak in the 1860s. The two Saxon

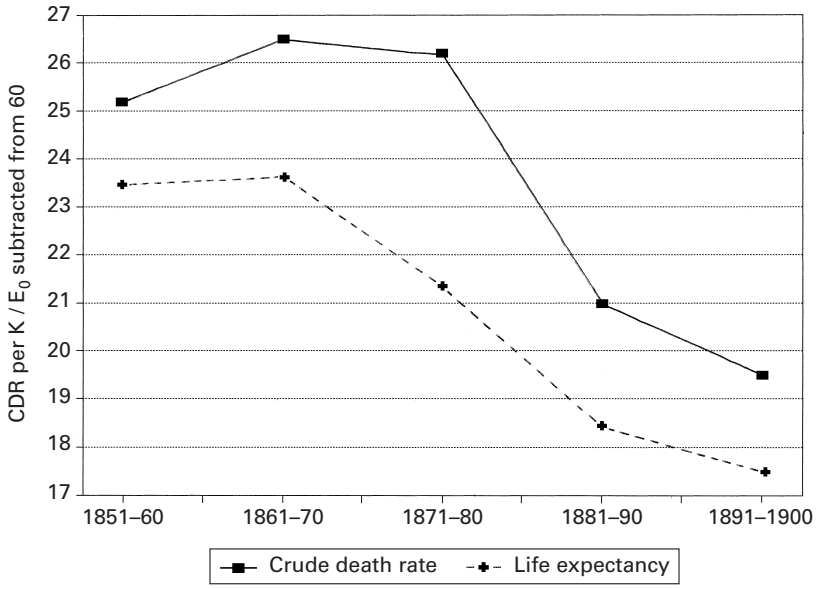

FIGURE 1. **Crude death rate and life expectancy at birth in the ten largest English towns, 1851–1900.** (Source: Calculated from J. Vögele, *Urban mortality change in England and Germany, 1870–1913* (Liverpool, 1998), Table 3, p. 37, and Simon Szreter and Graham Mooney, 'Urbanization, mortality and the standard of living debate: new estimates of the expectation of life at birth in nineteenth-century British cities', *Economic History Review* **LI** (1998), 84–112, Tables 1 and 8, and weighted according to population size. The figures for life expectancy at birth are subtracted from 60 to make the two curves move in the same direction and capable of being displayed close enough to each other to facilitate comparison. It is not the absolute level of the life-expectancy graph but the relation of its movement to that of the crude death rate that is significant.)

towns, Dresden and Leipzig, show level rates after declining in the 1850s. A common pattern emerges only from the 1880s, when there is a steady decline, delayed until the 1890s in the case of Hamburg, Frankfurt and Nuremberg.[15] Only at that stage do the German towns appear to be responding to common influences, and Vögele argues that it was the sanitary measures to which they were responding.[16]

The crude death-rates for the English towns can be turned into figures on the expectation of life at birth with the help of calculations published by Szreter and Mooney. That is a measure not distorted by changes in the age-structure of the population, and is therefore far more suited to comparison.[17] Figure 1 shows that the slight rise in the crude death-rate in the 1860s was not parallelled by life expectancy, which remained remarkably level. It also shows that the almost level crude death-rate of

the 1870s hides the fact that expectation of life at birth had already begun its marked improvement in that decade.

There has been some comment on the stagnation of English urban death-rates in the mid-century. The work of Szreter and Mooney indicates that a rise in the 1830s and 1840s had been checked by the 1850s but that there was no further improvement until the 1870s.[18] This should not be regarded as evidence of the irrelevance of the sanitary measures introduced during this interval. There is much to be said for the view that the early sanitary measures – the beginning of sanitary inspection and regulation, the provision of a central water supply (however limited) and the improved sewerage (even if it was at the expense of river pollution) – prevented matters getting worse in the 1860s despite continuing rapid urban growth.

That opinion would be reinforced if the rising death-rates in most of the German towns, where the beginnings of sanitary reform were delayed until the 1870s or 1880s, indicate a deterioration of conditions there. Unfortunately there is no way by which the crude death-rates provided by Vögele can be converted into either expectation of life at birth or age-specific or standardized death-rates. It is possible to do that only from 1877 onwards, when the fall in the crude death-rates is indeed mirrored by a fall in the standardized rates. That shows that it was not merely due to changes in the age-structures of the population. The rising crude death-rates before 1877 could well have been due to deteriorating environmental conditions. They could, however, have resulted from an increase in the proportion of the younger age-groups, for whom death-rates had always been particularly high.

That it is possible to resolve such issues with the data available for England and Wales but not with those available for Prussia, not to mention Germany, itself represents a significant difference between the two countries, and one to which we shall return.

Why should there have been so little German interest in sanitary reform in the 1850s and 1860s? Could this have been due to the peculiar circumstances that had led to the formulation of the English sanitary policy? Were other priorities adopted in Germany in the face of the high incidence of fatal disease in towns? The origins of the sanitary doctrines in English Poor Law policy would certainly have seemed irrelevant in Prussia. There methods of poor relief were left at the discretion of each local authority, while the state limited itself to defining which authority was responsible for whom. Nevertheless there were many who connected the widespread distress of the 1840s with government policy. They blamed it for the overstocking of trades that had caused wages to fall and for the misery in towns which were no longer able to protect themselves against

an undesired influx of the poor. Indeed, whether they looked at towns or at manufacturing districts, critics in Prussia even more than in England could have pointed to the economic, social and political arrangements as the cause of widespread disease.

Something of that sort happened in 1847 when the medical authorities commissioned an investigation by Dr Rudolf Virchow into a fever epidemic in the manufacturing districts of Upper Silesia. He diagnosed the outbreak as due to the general conditions of destitution and overcrowding that he found there, but ultimately his diagnosis was cultural and his prescription political. The stricken districts were inhabited by Poles, and nothing short of a Polish national revival, so Virchow argued, based on education and democratic self-determination could create the spiritual conditions under which similar disasters would be prevented in future. Such an emphasis was totally unacceptable to the Prussian authorities, as he well knew. Within four months of his return from Silesia he had launched a medical reform movement, projecting the medical profession as the natural spokesmen for the poor and claiming the social question as falling substantially within their sphere. This was a bid to enhance the status of the medical profession and to open up new fields of action for it by freeing it from subordination to the state bureaucracy. The medical reformers had seized the opportunity provided by the revolutionary ferment of 1848 to stake their claims and they suffered defeat and ostracism in the years of political reaction.[19]

We need to remember that the English sanitary movement had been sponsored by a central government department. It had harnessed the knowledge of local doctors to its purpose, but the role of the Poor Law Commission in sponsoring the investigations and formulating the programme had been crucial. After 1848 that role was taken up by the General Board of Health. In Prussia, on the other hand, the sort of initiatives by government departments that had characterized the English sanitary movement were ruled out after the suppression of Virchow's medical reform movement.

How little the Prussian authorities were interested in keeping up to date with developments in sanitary policy elsewhere is illustrated by their absence from the international congress in Brussels in 1852. There were only three German delegates, two of whom were physicians from Frankfurt, including Dr Varrentrap. The sole representative from Prussia was Count Cieszkowski, a philanthropic member of the Polish faction in the Prussian legislature with interests in economics and philosophy. There is no record of any connection with the Prussian medical authorities, whose publications carried no report of the conference nor indeed of its four successors between 1876 and 1884.[20]

One historian who has paid some attention to the problem of Prussia's, and indeed of Germany's, late start has suggested that it was due to a *laissez-faire* abstinence by the Prussian State from its traditional measures of medical police.[21] But state officials did not withdraw. They continued to operate as they had always done. The *Regulativ* of 1835, issued in the aftermath of the cholera epidemic of 1831–1832, shows them codifying measures of medical police along traditional lines. But such traditionalism offered no basis for central initiatives along innovative lines. Nothing was so traditional as the view that towns were graveyards of population, an assumption that Johanna Bleker has found to have been widespread among German doctors. She adds that it did not lead to any interest in the statistical investigation of urban mortality.[22]

In the absence of such investigations into the conditions of German towns, it was easy to assume that there was something uniquely terrible about the urban conditions in Britain, as these had been exposed by the investigations of the 1840s and 1850s. But there were plenty of German towns, both large and small, for which the British prescription could have been regarded as appropriate.

Although the British investigations had originally looked at the 50 largest towns, by the early 1850s as many as 243 towns had been investigated, including many that were relatively small, such as Alnwick and Launceston (only just over 6,000 inhabitants in 1851), and others, like Brighton (66,000), whose dire sanitary conditions owed little to industrialization.[23] Out of 82 towns in Prussia whose death-rates for 1865–1867 were published in 1908, exactly half had rates of over 30 per thousand, and 10 had rates of over 40 per thousand. They ranged in population from under 5,000 to over 100,000, with a preponderance of those between 10,000 and 50,000. Admittedly these were cholera years, but the figures for 1868–1871 were also very high. Out of 104 towns for which figures are available, 35, or roughly one-third, had death-rates of over 30 per thousand; 5 had rates of over 40 per thousand.[24] In England a death-rate of 23 per thousand had been regarded in the early 1850s as grounds for the compulsory establishment of a local board of health.

In England the Registrar-General published the death-rates of individual towns in what might be described as a league table, and set them against the rates of the 63 healthiest districts in the country, thereby providing a standard of what it was possible to achieve. The regular publication of death-rates became part of sanitary policy and they were reproduced in the local press across the country.[25]

Such information does not appear to have interested those responsible for public health in Prussia. Death-rates for local government units had indeed been routinely collected, but were not published except on rare

occasions until 1875, following the establishment of a department for medical statistics in the Royal Statistical Bureau.[26] On those rare occasions the form of the tables and the comments that accompanied them vividly demonstrate the absence of a sanitary perspective.[27] An article on the physical deterioration of the population of Berlin over the previous 30 years, published in 1860 in the journal of the Prussian Statistical Office, considered a wide range of explanations without ever mentioning the deleterious effect of the urban sanitary environment.[28] Nor did the towns themselves show any interest. Municipal statistical offices began to be set up in the 1860s but originally for reasons unconnected with any interest in public health. Only in the wake of the sanitary movement did they begin to publish such information. After 1890 the *Statistical Yearbook of German Towns* at last provided publicity for a comparison of urban death-rates, and belatedly created the sort of emulation that had existed in England since the mid-century.[29] The principal explanation for the lack of interest in sanitary reform in the 1850s and 1860s on the part of the Prussian state authorities is therefore to be found in a lack of concern over the level of urban death-rates.

A different kind of explanation may also be relevant. The high cost of a sanitary infrastructure suggests that this is something that only wealthy societies can afford. When a town embarked on a main drainage system, it embarked on something whose cost greatly exceeded what the authorities had been accustomed to spend, at least since the days of city fortifications. Britain in the 1850s and 1860s was a far wealthier country than Germany. A sanitary infrastructure of central water supply and main drainage, it could be argued, was the luxury of communities that were rich.

It may be significant that the two German cities that embarked on these works in advance of any others were particularly wealthy. Frankfurt managed to finance its main drainage system from the sale of town property without ever going into debt. So little was the question of cost an issue that Lindley's proposals were accepted in 1866 before any figures were available.[30] Nor had finance been a major obstacle in Hamburg, where the resources not just of the city but of the state were at the disposal of the Senate.[31]

The new sanitary initiatives, when they finally came, did not originate from the state bureaucracy but from among the liberal urban middle class. For them the mid-1860s was a time of confidence and expanding horizons, in contrast to the repressive 1850s. These initiatives were triggered by the cholera epidemic of 1866, in particular by Max von Pettenkofer's initiative in convening a cholera conference in the following year. Pettenkofer had become the leading German advocate of the new ideas on the importance

of sanitation, personal cleanliness, fresh air and rational diet. A professor of medical chemistry at the University of Munich, he had used his connections at court to have hygiene recognized as a separate subject in Bavarian universities and to become the first occupant of the chair of hygiene at Munich. He promulgated his own variant of the miasmic theory of disease causation, which ascribed an important role in the creation of the fatal miasma to the interaction of changing levels of the water-table with soil pollution from organic waste. He had been officially commissioned to undertake an investigation of cholera in 1854 and was Germany's leading expert on the subject. In the light of the traditionalist attitudes that prevailed in Prussia, Pettenkofer's Bavarian base and his good relations with the Bavarian authorities are highly significant.[32]

In the wake of Pettenkofer's cholera conference, the German sanitary movement found a collective voice in a number of associations and periodicals, all established between 1867 and 1873: the Hygiene Section of the annual Congress of German Scientists and Physicians in 1867, the Lower Rhenish Association for Public Health in 1869, the *German Public Health Quarterly* in the same year and the German Association for Public Health in 1873. After 1882 an annual supplement kept the readers of the *German Public Health Quarterly* up to date with the details of measures undertaken anywhere in the country and thereby hastened the process of technical diffusion.[33] Richard Evans has even suggested that the rise of the German sanitary movement owed more to the tendency to found nationwide conferences and organizations during the wave of national feeling in the late 1860s and early 1870s than to any impact of cholera epidemics. These organizations were certainly important; all but one transcended state boundaries and all were imbued with national feelings. But to emphasize their role at the expense of the impact of the cholera epidemic is to set up a false antithesis. It was the cholera epidemic that provided the occasion for the coming together, whereas the organizations became the media for dissemination.[34]

III

How long did it take the German sanitary reformers to catch up? If we look at central water supply, where the 1840s and 1850s had seen the greatest increase in English towns, in German towns it was to be in the 1870s and 1890s.[35] Even by the mid-nineties the proportion of towns in Germany had not quite reached the level recorded in England 20 years earlier (see Table 3).

As for main sewerage, the slow pace at which that was taken up owed much to the fact that the German movement was launched just at the time

TABLE 3
Towns with central water supply, 1870s and 1890s[a]

	Total no. of towns		*With waterworks*		
	In survey	*As per census*	*Nos.*	*% of survey*	*% of census total*
Population over 10,000					
England & Wales 1878	224	224	212	95	95
Germany 1876	136	271	72	53	27
Germany 1895	341	341	296	86	86
Population over 2,000					
England & Wales 1878[b]	831	831	387	47	47
Germany 1880	1,640	2,707	195	12	7
Germany 1895	1,627	2,891	877	54	30

Figures for Prussia when available were somewhat lower than those for Germany as a whole.[c]

[a] Calculated from *Return of urban water supply*, British Parliamentary Papers (hereafter BPP) 1878–9 (265), LXI, 21, and *Census for England and Wales for 1881*, counting the area of the Metropolitan Board of Works as one; E. Grahn, 'Die berechtigten Ansprüche an städtische Waserversorgungen', *Deutsche Vierteljahrschrift für Öffentliche Gesundheitspflege* **9** (1877), 108; R. Spree, *Health and social class*, in *Imperial Germany* (Oxford, 1988), Tables 22, 24 together with the census for the German Empire for 1880, 1890. The surveys used to construct this table identify places with water from a central supply. They are comparable in that none of them pay attention to the number of houses connected or to the constancy of the supply. It may be assumed that the percentages in the final column are the significant ones for the purpose of comparison, although the possibility that some of the places missing from the incomplete surveys may have had a central water supply cannot be ruled out.

[b] The original survey included 944 urban sanitary districts. The 1881 census has been used to remove 114 below the 2,000 population level. Of these 27 have been identified as having access to a central water supply, often one belonging to a large place nearby. That is not a totally reliable figure; the descriptions given made it not always easy to identify those that qualified.

[c] *Zeitschrift des königlichen Preussischen Statistischen Bureaus*, 1882, 1–28 for 1876; Spree, *Health and social class*, Table 22 for 1895.

of the British investigations into river pollution. This led to a determination to avoid the 'sad' experience of the British. In 1874 the Prussian state prohibited the disposal of untreated urban sewage into rivers. That added the need to undertake experiments in the irrigation of land with liquid sewage to the other technical problems and costs that faced any town that wished to provide itself with a main sewerage system. As late as 1892 only four German towns of over 50,000 inhabitants, a mere 9 per cent of the total, had introduced land irrigation as a form of sewage treatment. That is the same number and roughly the same percentage as for England and Wales in 1873. Taking all towns of over

TABLE 4
Main drainage schemes initiated in Germany, in towns with a population of over 1,000

Decades	*On a systematic plan*	*Not on a systematic plan*
1850–1859	4	1
1860–1869	17	5
1870–1879	17	6
1880–1889	64	15
1890–1899	186	35
1900–1909	305	23

Source: H. Salomon, *Die städtische Abwasserbeseitigung in Deutschland*, vol. 2, 802ff., and *Ergänzungsband* (Jena, 1907, 1911).

5,000 inhabitants, the German total in 1892 was 16. In England and Wales it had been 43 in 1873 and something over 100 in 1880.[36] After 1888 the Prussian authorities had begun to permit sewage to enter the rivers once all suspended matter had been removed, and the 1890s at last saw a sharp increase in the number of main drainage schemes (see Table 4).

Nor was the construction of a sanitary infrastructure made easier by the fact that the conversion of expert opinion had hardly begun when the severe economic crisis of 1874–1879, followed by long years of relative economic stagnation, depressed sentiment and militated against an optimistic policy of loan-financed investment. How much the spurt in the mid-1890s owed to the easing of the technical obstacles and how much to the economic upturn is impossible to tell.

Municipal authorities had traditionally regarded themselves primarily as stewards of municipal property (an emphasis that the Germans call *Vermögensverwaltung*). What was now called for was large capital investment in undertakings that would in some way have to cover their cost, and ambitious engineering works with long-term implications for maintenance. Allowance should be made for traditionalism and inertia in municipal life.

These three considerations – concerns over river pollution, the state of the 'economy' and traditionalism – go far to explain why until the mid-1890s there was little sign of the late-comer catching up, something that might have been expected and is familiar from other contexts. Even in the two decades before the outbreak of war it was only large cities that introduced sanitary provision comparable to those in England and Wales. But while these invested in their sanitary infrastructure so did much smaller English towns (see Table 5).

TABLE 5
Numbers of towns relying entirely on water carriage for disposal of excrement[a]

	Population (000*s*)	*Total no. of towns*		*Water carriage only*	*Percentage*	
		In survey	*As per census*		*Of survey*	*As per census*
Germany 1892	50+	45	45	9	20	20
Germany 1912	50+	89	97	41	46	42
England and Wales 1911	50+	95	95	55	58	58
England and Wales 1911	5+	629	629	302	68	48

[a] C. Hugo (H. Lindemann), *Deutsche Städteverwaltung*, 19; *Statistisches Jahrbuch der Deutschen Städte* **21** (1916), ch. XVI, Table VI; 'Sanitary conveniences in urban districts', in *Annual Report*, *Local Government Board for 1911*, pt 3, 1, 1i. *BPP* 1912–13 Cd 6982, XXXI. The English figure is for towns with not more than 4 per cent of sanitary conveniences of a type other than water closets. Three towns falling a little short of total water carriage have therefore been included in the German figure to be on the safe side.

In 1912 of all German towns of over 50,000 inhabitants at most 46 per cent relied *entirely* on water carriage for excrement disposal, a percentage that was even exceeded in England and Wales by towns with over 5,000 inhabitants. The figure for those over 50,000 was 58 per cent.

To take another example, in 1914 in England and Wales 99 per cent of places with over 2,000 inhabitants had a central water supply; in Germany in 1907 (the nearest year that provides comparable figures), it was 34 per cent and for places over 5,000 it was 67 per cent (see Table 6).

The 1890s and the early twentieth century, which witnessed such a remarkable increase in spending on sewerage and sewage treatment in the larger German towns, also saw a striking increase in expenditure on them, in English towns of every size, as improved methods of sewage disposal overcame the earlier problems, often at the price of extensive land purchase for irrigation. The study of local government expenditure by Bell and Millward has recorded at least a trebling of average capital expenditure on sewerage and sewage disposal in their sample of towns from the level of the later 1880s.[37]

Such evidence is available only from the mid-1880s onwards. But the total of outstanding loans at that date provides an indication of the amount already spent on sewerage and sewage disposal in the previous decades. Since it was the big cities that had taken the lead in the earlier years it is of some significance that on average the 19 big cities in Bell and Millward's sample had by then already raised loans of £83,000 each. That

TABLE 6
Towns with central water supply, early twentieth century[a]

	Total no. of towns		*With waterworks*		
	In survey	*As per census*	*Nos.*	*% of survey*	*% of total*
Population over 5,000					
England & Wales 1914	731	731	729	99	99
Germany 1907	1,097	1,194	801	73	67
Population over 2,000					
England & Wales 1914	1,029	1,029	1,015	99	99
Germany 1907	1,975	3,580	1,220	62	34

[a] Calculated from *Water undertakings* (*England and Wales*), *BPP* 1914 (395), LXXIX, 543, and *Census of England and Wales for 1911*, counting the County of London as one; P. Mombert, *Die Gemeindebetriebe in Deutschland: Schriften des Vereins für Socialpolitik*, vol. 128 (Leipzig, 1908), 10. The table provided in Dawson, *Municipal life and government in Germany* (London, 1914), 216 and reproduced in W. Krabbe, *Kommunalpolitik und Industrialisierung* (Stuttgart, 1985), p. 84, is also based on that in Mombert but confines itself to German towns in the legal as opposed to the statistical sense of that term, thereby ignoring a further 281 places with population over 2,000 for which Mombert also provides evidence.

was just under a quarter of the total amount raised by the end of the period.[38] That is consistent with the evidence drawn from the other sources in this article.

Viewed in 1914 and even more in the 1920s the two countries can be regarded as being on the same path, with Germany lagging somewhat behind in the process that is now regarded as the obvious modernization of urban life. But for almost the whole of the second half of the nineteenth century, it is the contrast in the urban sanitary policies in the two countries, not their similarity, that stands out.

How did German towns actually manage? As I have already suggested, they largely did so by shutting their eyes to the problem (see Table 7). In 1877 Vögele's ten German towns had a crude death-rate of 94.7 per 10,000 from typhoid fever, dysentery, diseases of the digestive system and the closely related symptom described as 'weakness of life'. That of his English towns in the 1870s for the same disease complex was 26.1 per 10,000. Yet by 1907 the death-rate in the German towns from these diseases, which were peculiarly susceptible to the effects of sanitary reform, had fallen by 61.8 per 10,000 to 32.9. This compares with a fall in the English towns over roughly the same period of approximately 7.6 to a level of 18.5 per 10,000. Thus despite this enormous improvement the German figure was still well above that for the English towns. There were

TABLE 7
Death-rates ascribed to a complex of digestive diseases per 10,000 in the ten largest German and English towns

	Germany		
	1877	*1907*	*Decline*
Typhoid fever	4.7	0.3	4.4
Dysentery	1.4	0	1.4
Digestive system	61.3	23.2	38.1
'Weakness of life'[a]	27.3	9.4	17.9
Total	94.7	32.9	61.8
	England & Wales		
	1871–1880	*1901–1910*	*Decline*
Enteric & simple continued fever	4.1	0.9	3.2
Diarrhoea & dysentery	12.3	7.9	4.4[b]
Digestive system	9.7	—	
Total	26.1	18.5	7.6

Source: Calculated from J. Vögele, *Urban mortality change in England and Germany, 1870–1913* (Liverpool, 1998), Tables 11, 12, 18, 20.

[a] See text.

[b] This is approximate, since it excludes changes in the incidence of 'diseases of the digestive system' in 1891–1900 and 1901–1910. These were no longer recorded in this form.

differences in infant-feeding that probably account for that, but it cannot account for the enormous fall in the relevant German death-rate over these 30 years. It is generally accepted that rates of breast-feeding actually deteriorated in the last quarter of the nineteenth century. That would suggest that we are looking largely at the effect of sanitary measures. Their impact on the German death-rate for the digestive disease complex was so much greater than in England, exactly because matters had been allowed to become so bad before 1877.[39]

A second point to bear in mind is that sewers did exist in German towns, as they had done in English towns, before the introduction of comprehensive town sewerage. They would have been either open or covered and would have conveyed the surface water to a nearby ditch or water-course. They would have been used, with or without the connivance of the town authorities, to dispose of household waste, often including urine and faeces. Such sewers differed from the emphasis on comprehensiveness and system that characterized the new kind of sewerage. The

sewerage schemes designed for English towns after the late 1840s by the new school of sanitary engineers and constructed in the 1850s and 1860s were often completed in stages. But they differed significantly from the partial sewerage that had been carried out before in that they were planned as part of a comprehensive system for the town, with all that this implied for the size of the pipes and the choice of gradients.[40]

In Frankfurt, a city that prided itself on its wealth, health and amenities, these two concepts clashed in a spectacular way. The city surveyor had pursued an active programme of sewer-building since 1839, but in 1859 after several years of protest the city council cut off the necessary funds. Led by Dr Varrentrapp, the opponents of this piecemeal sewering demanded plans for a comprehensive system on the English model, capable of removing all surface water, household-waste water and faeces. They criticized the city surveyor for being unacquainted with the principles of sewer construction as pioneered in England and Hamburg. Their victory was to benefit the sewerage of the old parts of the city in the long run, but what was immediately at stake were the amenities of the new West End. Its wealthy residents were content with nothing less than water closets and a high-quality infrastructure to prevent flooding and pollution of the soil.[41]

Frankfurt was a pioneer. Elsewhere the clash of the two concepts occurred later: in Hanover between 1876 and 1889, in Bielefeld between 1875 and 1890, in Münster between the 1880s and 1892, to give some examples.[42]

Whenever a town succeeded in tapping a larger supply of water, its drainage became a more acute problem. Water closets were emptied into sewers designed for surface and waste water. Older forms of sanitation had belonged to a household economy where water was available only with much labour. Households therefore did not use the quantities of water that they were to do later, and human waste was mainly disposed of separately from waste water. The demand for a larger water supply, when it came, frequently stemmed from local industry and was effected through the influence of local manufacturers on the municipality.[43] In that process sanitary arguments served at best to support a case made primarily for economic reasons. The establishment of such industries as textiles, iron and steel, leather or chemicals therefore caused two problems. It led to environmental pollution and also created the need for radically new forms of drainage. In this way the later industrialization of Germany helps to explain the later introduction of the new sanitary measures there. Here is an explanation not in terms of urban growth, of which there was already plenty in the second quarter of the century, but of industrialization and the demands that industry made on local water resources.

Before the provision of a central water supply and irrespective of a certain amount of sewer-building, sanitary policies concentrated on improving the traditional forms of storing human excrement. Cess-pits began to be lined with bricks and cement and covered over. They began to be made smaller and to be emptied more frequently, as municipal authorities assumed responsibility for the process in place of house-owners. Various materials were used to absorb moisture and reduce odour. Finally cess-pits began to be replaced by tubs and pails, which could be removed in a sealed state to a depot to be emptied there and washed, before being re-used, and by the use of various materials to absorb moisture and reduce odour.

Such policies were common to England and Germany, and the available evidence suggests that German towns were no quicker to innovate than English ones. On the contrary, in the early 1890s cess-pits rather than tubs and pails were still the rule in German towns, even those of over 50,000 population.[44] We have some useful comparative figures for these larger towns in 1910–1911. Not only did fewer German towns rely entirely on water carriage, but those dependent to some extent on other methods definitely included a larger number, and almost certainly also a larger proportion, that relied on cess-pits rather than tubs and pails. The contrast was greatest among towns that used no tubs or pails at all[45] (see Table 8). This extensive survival of the cess-pit even in large German towns was to some degree compensated for by the use of pneumatic pumps for the purpose of emptying them. This was less usual in England, where householders generally added the ashes from their grates to the excreta to keep it dry for removal by hand labour.[46]

To sum up so far, the main difference between the sanitary movements in the two countries lay in their timing. In this article I have tried to answer the two questions that need to be addressed. First, why was there a difference of 25 years between the beginnings of the respective sanitary movements? Secondly, why was the difference in sanitary provision still so great in the early 1890s? Indeed even in 1914 only in the category of the largest cities were sanitary provisions comparable. It is on these large cities that the German historiography has focused, to the neglect of the national picture, and Vögele's recent book is yet another example of that trend.[47]

IV

In other respects there were only minor differences. The technology of sewage treatment might be expected to differ little in the two countries; the diffusion of technical ideas was rapid and efficient at the time. In actual fact there were some differences, due partly to geography, partly to government policy. In both countries coastal towns emptied untreated

TABLE 8
Methods of removal of faeces in towns of populations over 50,000

	Germany 1910		*England & Wales 1911*	
	N	%	N	%
Entirely by water carriage	31	36	55	58
Predominantly by water carriage	25	27	25	26
Predominantly by conservancy	30	32	15	16
Total and as percentage of all	86[a]	95[a]	95	100
Conservancy methods:	*Germany 1910 Minimum figure*[b]		*England & Wales 1911 Complete figure*	
With only fixed receptacles (cess-pits)	21		4	
Incl. those predominantly so		25		21
With only moveable receptacles (tubs and pails)	2		4	
Incl. those predominantly so		4		18
Uncertain	1	1	1	1

[a] This total is from an incomplete survey that covered 86 out of the 93 towns with a population over 50,000, hence the percentage is given as 95 not 100.

[b] There is no information on methods of disposal in the 25 towns described here as predominantly water carriage towns.

Sources: Calculated from *Statistisches Jahrbuch der Deutschen Städte* **19** (Breslau, 1913); *41st Annual Report of the Local Government Board for 1912–13*, pt 3, 413; *BPP* 1913 Cd 6982 xxxi.

sewage into the sea, and estuary towns mistakenly relied on the tides for the same purpose. It was just that there were more of these in Britain than in Germany. Furthermore, despite much propaganda in Germany in favour of applying sewage to the land, the reliance on land irrigation was much the same in both countries.[48]

It was in the invention of mechanical methods of separating the solids in the sewage from the liquid that German engineers excelled. In this they were responding to state regulations that allowed sewage to enter the rivers after the removal of the solid matter and relied on the rivers to dilute the liquid and render it harmless. English rivers tended to be smaller, and English regulations, as applied by the Local Government Board when considering applications for loan powers, regarded that practice as unacceptable. The Board insisted on land irrigation before liquid sewage was allowed to enter rivers, but it became increasingly difficult for larger towns in some parts of the country to find enough suitable land. This gave English experts an incentive to reproduce the bacteriological action of the

soil artificially in ways that would economize in the use of land. These artificial bacteriological methods were little used in pre-war Germany. In Britain, as in the USA, the adoption of this technology led to a further break-through just before 1914, the development of the activated sludge process.

The diffusion of that technology belongs to the history of the inter-war years. It coincided with the official encouragement of land irrigation in Germany to save on the import of fertilizers. In consequence the technical difference between the two countries in these matters was to reach significant proportions in the 1930s.[49]

That was one way in which central government policy influenced the history of sanitary provisions in both countries. There were others, as we shall see. But ultimately sanitary conditions depended in both countries on measures undertaken by local government. In England the very system of local authorities was largely created in response to the changing needs of sanitary administration. The sanitary powers authorized by the Public Health Act of 1848 could be exercised by the reformed municipal corporations. In other urban areas a local board of health could be established especially for the purpose. This tendency to the establishment of *ad hoc* local authorities, each tailored to the particular duties which it was to exercise – Highway Boards, Burial Boards and so on – was to be reversed after the recognition by the Royal Sanitary Commission of 1869–1870 of the extensive range of duties required for the administration of public health. The way in which the English system of multi-purpose local authorities was constructed largely around the concept of a public health administration is an important part of the history of English local government and has been described by me elsewhere.[50]

There was no such widespread development of *ad hoc* authorities in Prussia nor, I believe, elsewhere in Germany. Strongly influenced by English precedent, the German sanitary reformers tried in vain to persuade the *Reich* authorities in the early 1870s to set up local boards of health and to prescribe their duties. To do so would have infringed the powers of the individual states, which the *Reich* refused to do.[51] It confined itself to setting up an Imperial Health Authority in Berlin with limited advisory powers only and a brief to persuade the individual states to cooperate in the provision of health statistics. The states were in no hurry to do so and it was 1892 before a regular series of imperial demographic statistics began to appear.[52] Health legislation at imperial level was rare. Even then, as with the Vaccination Law of 1874 and the Food Adulteration Law of 1879, the role of the Imperial Health Office was limited to recommendations on the procedures to be enacted. Their execution was left to the individual states.

The response of the Prussian state to the petition of the reformers was even more negative.[53] There was no single authority responsible for measures of public health in any district. Powers of medical police were exercised by the local police authority, which was an arm of the state. They were largely limited to regulation and inspection. The communal authority, the *Gemeinde*, was free to assume whatever powers were not reserved to the state, and these could include the provision of a sanitary infrastructure and whatever else was considered necessary. The medical officer reported to the police authority, the surveyor to the communal authority. The duties of the former remained traditional, which meant that they were mainly concerned with forensic medicine, and any reform of the Prussian state medical service was delayed until 1899. Not until then were there any significant steps taken to bridge the gap between these two administrations by the establishment of so-called health commissions. These provided towns with a population of over 5,000 with a new and badly needed source of initiative in matters of public health.[54] All this was in marked contrast to the English sanitary authorities, which had been obliged to appoint both a surveyor (since 1848) and a medical officer of health (in London since 1855, elsewhere since 1872).

This difference in the structure of the local health authority reflected wider differences in the relation between local authority and the state. In England the state exerted influence on the local authority through central inspection and publicity, and through its loan-sanctioning powers. It is often assumed that in Germany there was nothing like the central government influence that has been a feature of the history of public health policy in England. In 1914 W. H. Dawson, the great authority on Germany, had drawn a contrast between the two countries in that respect, and a recent comparative study by a German historian ascribed what he regarded as the greater flexibility and creativity of German municipal authorities in matters of public health around 1900 to their distance from the state.[55]

That is not how I see the matter. It was in England that the relation was a distant one, between far-off Whitehall and localities. In Prussia, as in all German states, the state had a presence at several intermediate levels of administration, and it was from there, and particularly from the district level, that its influence was chiefly exercised. Towns as diverse as Dortmund, Münster, Solingen, Hanover and Essen felt the persuasive power of the district president in matters of water supply or his veto over inappropriate sewage disposal. German historians have often tended to underplay the role of the state in their approach to the history of the sanitary movement. They have pointed out that the initiative was local, by

which they have tended to assume that it was municipal. Wolfgang Krabbe has been one of the few to draw attention to the significant role played locally by the state.[56]

Our assessment of the role of the state in Prussia in relation to sanitary policy will therefore depend on whether we pay attention to its central or its local institutions, to legislation or to administration. It took a long time before central government showed much interest in the new sanitary emphasis. Significant legislation was delayed until the turn of the century. The reform of the state medical service at local level (*Kreisarztgesetz*) has already been mentioned; it was part of a fuller review of the state medical administration, but the only part of it to lead to legislation. At the federal level a law of 1900 on infectious diseases (*Reichsseuchengesetz*) introduced compulsory notification for a number of exotic diseases; it was left to the individual states to administer it and in 1905 Prussia enacted its own *Seuchengesetz* ('epidemic law'), which extended compulsory notification to a range of more common indigenous diseases. Between 1901 and 1913 several other state initiatives suggest that public health had become now a matter of interest to the state, within the context of a declining birth-rate and a concern over a healthy population as part of national resources.[57] On the other hand state administrative action at district level has a different chronology. A long-standing aspect of medical police, it concerned itself with sanitary matters well before the legislative innovations of the turn of the century, as district presidents and their medical officials became familiar with the new sanitary knowledge.

The difference in the two countries between the location of the state *vis à vis* the representative local authorities makes it hard to strike a fine balance between the degrees of state intervention in public health. What can be said is that any impression of a major difference between the two countries is almost certainly an illusion, created either by overestimating the achievement of the English central authority, as earlier historians used to do, or by overlooking the substantial role of the president of the Prussian district administration.

V

To sum up, comparative history can be pursued in various ways. One can look at the same phenomenon in two places diachronically, or take the same period and look at the differences. In this article I have done first the one and then the other. I have tried to account for what from the first point of view looks like delay, and then, switching to the other perspective, for how people existed under different sanitary regimes in the same period.

The difference in the timing of the sanitary movement in the two countries and its implications for mortality caused by the complex of digestive diseases has been the principal conclusion that I have drawn from my investigation. Otherwise I have found many similarities under different local circumstances. That applies to the technology of sewage treatment, to the local nature of the sanitary initiatives and to the relationship between the representative local authority and the state.

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ENDNOTES

1 E. P. Hennock, 'Vaccination policy against smallpox, 1835–1914: a comparison of England with Prussia and Imperial Germany', *Social History of Medicine* **11** (1998), 46–71.

2 All three pieces were originally conceived as part of a comparative study of social policies in England and Germany but have outgrown the dimensions of that book.

3. Lorenz Stein, *Die innere Verwaltung*, *1. Hauptgebiet*. *2. Theil*, *Das öffentliche Gesundheitswesen in Deutschland*, *England und anderen Ländern* (Stuttgart, 1867).

4 C. Finkelnburg, *Die öffentliche Gesundheitspflege Englands nach ihrer geschichtlichen Entwicklung und gegenwärtigen Organisation*, *nebst einer vergleichenden Übersicht der sanitären Institutionen in anderen Culturstaaten* (Bonn, 1874); J. Uffelmann, *Darstellung des auf dem Gebiet der öffentlichen Gesundheitspflege bis jetzt geleisteten nebst einer vergleichenden Darstellung des in Deutschland geleisteten* (Berlin, 1878). Gerard Kearns, W. Robert Lee and John Rogers, 'The interaction of political and economic factors in the management of urban public health', in Marie C. Nelson and John Rogers eds., *Urbanisation and the epidemiological transition* (Uppsala, 1989), 9–81; this article deals also with Sweden. See also Michael Toyka-Seid, '"Sanitary Idea" und "Volksgesundheitsbewegung": zur Entstehung des modernen Gesundheitswesens in Grossbritannien und Deutschland im 19. Jahrhundert', in H. Berghoff und D. Ziegler eds., *Pioneer und Nachzügler?*, Arbeitskreis Deutsche England-Forschung, Veröffentlichung 28 (Bochum, 1995), 145–66; and J. Vögele, *Urban mortality change in England and Germany*, *1870–1913* (Liverpool, 1998), reviewed by me in *German History* **17**:4 (1999). Dorothy Porter ed., *The history of public health and the modern state* (Amsterdam/Atlanta, 1994) encompasses 11 countries including contributions on Germany by Paul Weindling and on Great Britain by Christopher Hamlin (pp. 119–31, 132–64); the element of comparison is to be found in the editor's introduction. Ludwig Telecky's *Gesundheitsfürsorge in Deutschland*, *England und USA* (Berlin, 1950) is written from the perspective of social medicine and pays no attention to sanitary provision.

5 Christopher Hamlin, *Public health and social justice in the age of Chadwick* (Cambridge, 1998), 90. The thesis of Hamlin's book is echoed in his contribution in Porter ed., *History of public health*, 132–64. See also J. V. Pickstone, 'Death, dirt and fever

epidemics: rewriting the history of British "public health" 1780–1850', in T. Ranger and P. Slack eds., *Epidemics and ideas* (Cambridge, 1992), 125–48.

6 Hamlin, *Public health and social justice*, 219, 243, 187.

7 On the importance of recourse to the Court of Chancery by landowners and the effect of legal injunctions in obliging towns to address themselves seriously to the technical problems of sewage disposal see B. Luckin, *Pollution and control: a social history of the Thames in the nineteenth century* (Bristol, 1986), 160–1. For river pollution in general see A. S. Wohl, *Endangered lives* (London, 1984), 233–56.

8 *Congrès général d'hygiène de Bruxelles*, *session de 1852* (Brussels, 1852). See F. O. Ward's presentation of the 'new English sanitary system' at the plenary session, the detailed discussion in the section dealing with sewers and privies and the response to this in the revised text of the resolutions on the subject (pp. 29–32, 95–104, 143–9, 240–3).

9 R. J. Evans, *Death in Hamburg: society and politics in the cholera years*, *1830–1910* (London, 1990), 133–4, 145–6; John von Simson, *Kanalisation und Städtehygiene im 19. Jahrhundert* (Düsseldorf, 1983), 61–87. Evans's is the outstanding study in English of the public health of any German city. Hamburg is, however, very untypical of German cities in general.

10 For further details on Frankfurt see below, section III.

11 For Frankfurt and Berlin see von Simson, *Kanalisation*. The same author's essay in English, 'Water supply and sewerage in Berlin, London and Paris', in H. J. Teuteberg ed., *Urbanisierung im 19. und 20. Jahrhundert* (Cologne and Vienna, 1983), 429–39, devotes only a brief paragraph to Berlin. For Berlin's death-rates see T. Weyl, 'Assanierung', in T. Weyl ed., *Handbuch der Hygiene*, *Supplement*, vol. 4 (Jena, 1904), 12.

12 This is recognized in J. Reulecke, *Geschichte der Urbanisierung in Deutschland* (Frankfurt on Main, 1985), 58. Reulecke's is the most significant modern contribution to the general study of urban public health policy in Germany. Among many publications see 'Einleitung' and 'Nachwort' in J. Reulecke and Adelheid Gräfin zu Castell Rüdenhausen eds., *Stadt und Gesundheit* (Stuttgart, 1991), 11–19, 325–32; J. Reulecke, 'Von der Fürsorge über die Vorsorge zur totalen Erfassung: Etappen städtischer Gesundheitspolitik zwischen 1850 und 1939', in the same editors' *Die Stadt als Dienstleistungszentrum: Beiträge zur Geschichte der 'Sozialstadt' in Deutschland im 19. und frühen 20. Jahrhundert* (St Katharinen, 1995), pp. 395–416.

13 Vögele, *Urban mortality change*, Table 3, p. 37.

14 Evans, *Death in Hamburg*, 487–507.

15 The level rates of the two Saxon towns would repay more attention than they have so far received. The other marked difference is that Frankfurt's rates are very much lower than those of any other town. This might be explained, at least in part, by the extensive area of what had once been a sovereign imperial city. In 1880 houses and yards constituted only 5.2 per cent of the urban area, far less than in any other Prussian town of a population over 100,000. By 1905 this had risen to 13 per cent, still less than in any other town with a population over 150,000 except for Cologne; see Heinrich Silbergleit, *Preussens Städte* (Berlin, 1908), 4–7, 162–3. For the territorial expansion of Cologne in 1888 see Brian Ladd, *Urban planning and civic order in Germany*, *1860–1914* (Cambridge, Mass., 1990), 211–14.

16 See Vögele, *Urban mortality change*, p. 166. For his evidence see Table 7, below.

17 Simon Szreter and Graham Mooney, 'Urbanization, mortality and the standard of living debate: new estimates of the expectation of life at birth in nineteenth-century British cities', *Economic History Review* **51** (1998), 84–112, Tables 1 and 8.

18 Szreter and Mooney, 'Urbanization', Table 6 and Fig. 1.

19 Rudolf Virchow, 'Mittheilungen über die in Oberschlesien herrschende Typhus-Epidemie', in Virchow's *Gesammelte Abhandlungen aus dem Gebiet der öffentlichen Medicin und der Seuchenlehre* (Berlin, 1879), vol. I, 214–334; K. Figlio and P. Weindling, 'Was social medicine revolutionary? Rudolf Virchow and the Revolutions of 1848', *Bulletin of the Society for the Social History of Medicine* **34** (June 1984), 10–18.

20 *Congrès général*, 2; B. Haunfelder, *Biographisches Handbuch für das Preussische Abgeordnetenhaus, 1849–1867* (Düsseldorf, 1994), 79. The international Congress for Hygiene and Demography of 1887, held in Vienna, was the first to be reported in the semi-official and deeply conservative *Vierteljahrschrift für gerichtliche und öffentliche Medicin und öffentlichen Sanitätswesen* (the last three words had been added to the title only in 1864).

21 Reulecke, *Geschichte der Urbanisierung*, 63, and 'Von der Fürsorge', 396–7.

22 Johanna Bleker, 'Die Stadt als Krankheitsfaktor: eine Analyse ärztlicher Auffassungen im 19. Jahrhundert', *Medizinhistorisches Journal* **18** (1983), 118–36, esp. pp. 119–23.

23 R. A. Lewis, *Edwin Chadwick and the public health movement 1832–1854* (London, 1952), 339–40.

24 Silbergleit, *Preussens Städte*, Table 7*, pp. 168–9*, and Table 1, pp. 4–6.

25 F. Lewes, 'The GRO and the provinces in the nineteenth century', *Social History of Medicine*, **4**:3 (December 1991), 486–8; S. Szreter, 'The GRO and the public health movement in Britain, 1837–1914', ibid., 435–63.

26 *Festschrift des königlichen preussischen statistischen Bureaus zur Jahrhundertfeier seines Bestehens* (Berlin, 1905), vol. I, 43–7; Bleker, 'Die Stadt als Krankheitsfaktor', 128.

27 These comments are based on an examination of the three most relevant publications of that period: 'Über die Anzahl der Geburten, neu geschlossenen Ehen und Todesfälle im Preussischen Staat 1852–1854', *Mittheilungen des statistischen Bureaus in Berlin* (hereafter *MSBB*) **9** (1856), 119–70; 'Über die Sterblichkeit der lebend geborenen Kinder in Berlin von Tage der Geburt bis zum Alter von 12 Monaten', *MSBB* **10** (1857), 177–92; and Ernst Engel, 'Die Sterblichkeit und die Lebenserwartung im preussischen Staate und besonders in Berlin', *Zeitschrift des königlich preussischen statistical Bureaus* **1** (1861), 322–34, and **2** (1862), 65–9.

28 'Über die Verschlechterung der physischen Beschaffenheit der Berliner Bevölkerung in neuerer Zeit', *MSBB* **13** (1860), 145–57.

29 See *Städtestatistik und Stadtforschung: Leistungen, Aufgaben, Ziele: Hundert Jahre Verband Deutscher Städtestatistiker 1879–1979* (Hamburg, 1979). But for the period after 1882 see also the annual supplements to the *German Public Health Quarterly* mentioned below.

30 Von Simson, *Kanalisation*, 130–48. The fullest study of Frankfurt's sanitary history is Thomas Bauer, *Im Bauch der Stadt: Kanalisation und Hygiene in Frankfurt am Main 16.–19. Jahrhundert* (Frankfurt on Main, 1998).

31 Vögele, *Urban mortality change*, 152.

32 On Pettenkofer see Evans, *Death in Hamburg*, 237–43; E. E. Hume, *Max von Pettenkofer* (New York, 1927); and K. Kasskalt, *Max von Pettenkofer* (Stuttgart, 1948).

33 See Alfons Labisch and Florian Tennstedt, *Der Weg zum "Gesetz über die Vereinheitlichung des Gesundheitswesens" vom 3. Juli 1934* (Düsseldorf, 1985), vol. 1, 27–31. This information is reproduced in Alfons Labisch, *Homo hygienicus: Gesundheit und Medizin in der Neuzeit* (Frankfurt, 1992); see also Paul Weindling, 'Public health in Germany', in Porter ed., *History of public health*, 119–31, a masterly survey but too brief for most purposes, and Heinz-Jürgen Brand, *Die "Deutsche Vierteljahrschrift für Öffentliche Gesundheitspflege" in den ersten Jahren ihres Erscheinens 1869–1885 und ihre Bedeutung in der ärztlichen Hygienebewegung am Ende des 19. Jahrhunderts*, unpublished

dissertation, Free University of Berlin, School of Dental, Oral and Maxillary Medicine, 1986; *Jahresberichte über die Leistungen und Fortschritte auf dem Gebiet der Hygiene* **1** (1882), and following.

34 See R. J. Evans, 'Epidemics and revolutions: cholera in nineteenth-century Europe' in T. Ranger and P. Slack eds., *Epidemics and ideas* (Cambridge, 1992), 171. Evans makes a similar point in *Death in Hamburg*, 475, but in a milder and more acceptable form. Bleker and Vögele also regard cholera as irrelevant but provide no alternative explanation for the timing of the sanitary movement, adding that it started accidentally at just the right time when urban risks were historically most acute; see Bleker, 'Die Stadt als Krankheitsfaktor', 126, and Vögele, *Urban mortality change*, 160. See my review of Vögele in *German History* **17**:4 (1999), 596–9 on this.

35 J. A. Hassan, 'The growth and impact of the British water industry in the nineteenth century', *Economic History Review* **38** (1985), 531–47, Table 3; R. Spree, *Health and social class in Imperial Germany* (Oxford, 1988), Table 24.

36 C. Hugo (H. Lindemann), *Die Deutsche Städteverwaltung* (Stuttgart, 1901), 19; *Return of … sewage farms*, *BPP* 1873 (134), LVI, 287; John Sheail, 'Town wastes, agricultural sustainability and Victorian sewage', *Urban History* **23** (1996), 189–210 (figure on p. 209). Cf. Spree, *Health and social class*, 133–8, for the marked inequality in sanitary provision between large towns in Prussia and those of lesser size. My Tables 3, 5 and 6 here place that inequality into an Anglo-German comparison.

37 F. Bell and R. Millward, 'Public health expenditure and mortality in England and Wales, 1870–1914', *Continuity and Change* **13** (1998), 221–49. I am grateful to the authors for providing me with the numbers used in the construction of their Figure 1 on p. 233. That graph also records a startlingly large increase in 'total expenditure on sanitation' in the period 1890–1905, far larger than that recorded as being spent on sewers. In addition to expenditure on sewers this is made up of expenditure on streets, a category that would have consisted mainly of paving, and its repair and improvement, and on 'other purposes'. The latter is by far the largest category, accounting at its peak for 60 per cent of the 'sanitary expenditure', but it consists not only of miscellaneous sanitary expenditure but to an unknown degree also of non-sanitary expenditure of various kinds. It is impossible to know whether any of it ought to be counted under expenditure on sewers and I have therefore ignored it.

38 Again I am grateful to Robert Millward and Frances Bell for providing me with the figures for outstanding loans for the 19 towns in their sample with a population of 50,000 or more in 1883. These are markedly higher than those used in their Figure 2 on p. 234 of the article referred to in n. 37, which are based on a total of 36 towns of various sizes.

39 Vögele, *Urban mortality change*, 54–63, 82–3.

40 Such comprehensiveness might sometimes stop short of outlying townships and of course of areas only incorporated later.

41 Bauer, *Im Bauch der Stadt*, 161–93, 14–27.

42 Ingo Tamm, *Die Entwicklung des Öffentlichen Gesundheitswesens an Beispielen aus Hannover und Linden* (*1850–1914*) (Tecklenburg, 1992), 275–9; Georges Knaebel, 'Historical origins and development of a sewerage system in a German city: Bielefeld 1850–1914', in J. A. Tarr and G. Dupuy eds., *Technology and the rise of the networked city in Europe and America* (Philadelphia, 1988), 190–4; Wolfgang Krabbe, *Kommunalpolitik und Industrialisierung* (Stuttgart, 1985), 215–18.

43 For evidence to this effect from the Prussian Rhineland see J. C. Brown, 'Coping with crisis? The diffusion of waterworks in late nineteenth-century German towns, *Journal of Economic History* **48** (1988), 307–18, and 'Public reform for private gain? The case

of sanitary infra-structure in German cities 1880–1887', *Urban Studies* **26** (1989), 2–12. For a similar situation in English towns see Hassan, 'Growth and impact', 540–3; C. Hamlin, 'Muddling in bumbledom: on the enormity of large sanitary improvements in four British towns 1855–1885', *Victorian Studies* **32** (1985), 55–83.

44 Hugo, *Städteverwaltung*, 19.

45 *Statistisches Jahrbuch der Deutschen Städte* **19** (Breslau, 1913), 520–2; 'Sanitary conveniences in urban districts', in *Annual report*, *Local Government Board for 1912–13*, pt 3, 1, 1i; *BPP* 1913, Cd 6982, XXXI, 413.

46 For Germany see the comment on p. 475 in the *Statistische Jahrbuch*, **17** for 1907 (Breslau, 1910) that the cess-pits were 'predominantly' emptied pneumatically. For England see Louis C. Parker and Henry R. Kenwood, *Hygiene and public health* (4th edn, London, 1911), 74, 76, where they mention both methods but pay more attention to hand labour, while George Reid (*Practical sanitation* (15th edn, London, 1910), 161–3) focuses exclusively on methods involving adding ashes.

47 *Urban mortality change*; for another example see Beate Witzler, *Grossstadt und Hygiene: Kommunale Gesundheitspolitik in der Epoche der Urbanisierung*, supplementary number 5 of *Medizin*, *Geschichte und Gesellschaft* (Stuttgart, 1995).

48 For the debate over rival methods of sewage disposal and the defeat of those advocating the direct application of human waste to the land, see John von Simson, 'Die Flussverunreinigungsfrage im 19. Jahrhundert', *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* **65** (1978), 370–90.

49 J. M. Sidgwick and J. E. Murray, 'A brief history of sewage treatment', *Effluent and Water Treatment Journal* **16** (1976), 403–9; W. P. Dunbar, *Leitfaden für die Abwasserreinigungsfrage* (2nd edn, Munich, 1912); Peter Münch, *Stadthygiene im 19. und 20. Jahrhundert* (Göttingen, 1993), 105–6.

50 E. P. Hennock, 'The creation of an urban local government system', in H. Naunin ed., *Städteordnungen des 19. Jahrhunderts* (Cologne and Vienna, 1984), 19–43.

51 Ute Frevert, *Krankheit als politisches Problem* (Göttingen, 1984), 233; Alfons Fischer, *Geschichte des Deutschen Gesundheitswesens* (Berlin, 1933), vol. 2, 304–7. This frustrated appeal to the *Reich* and to the state suggests that the sanitary reformers did not originally hold the view, frequently expressed subsequently, that the public health strategies of municipalities and state should be fundamentally different. See for instance, Labisch, *Homo hygienicus*, 141. It was a distinction imposed on them by the political facts.

52 Reichsgesundheitsamt ed., *Das Reichsgesundheitsamt 1876–1926* (Berlin, 1926).

53 Labisch and Tennstedt, *Der Weg*, vol. 1, p. 44.

54 Ibid., 44–50; Flinzer, 'Die Gesundheitspolizei', in R. Wuttke ed., *Die Deutschen Städte* (Leipzig, 1904), vol. 1, 461–503.

55 W. H. Dawson, *Municipal life and government in Germany* (London, 1914), 190; Toyka-Seid, '"Sanitary Idea" und "Volksgesundheitsbewegung"', 151–2.

56 Wolfgang R. Krabbe, *Die deutsche Stadt im 19. und 20. Jahrhundert* (Göttingen, 1989), 37–44, and *Kommunalpolitik und Industrialisierung*, passim.

57 Some of these are discussed in Paul Weindling, 'Hygienepolitik als sozialintegrative Strategie im späten Deutschen Kaiserreich', in A. Labisch and R. Spree eds., *Medizinale Deutungsmacht im sozialen Wandel des 19. und frühen 20. Jahrhunderts* (Bonn, 1989), 37–55; for others more specifically concerned with the sanitary infrastructure see *Soziale Kultur und Volkswohlfahrt wärend der ersten 25 Regierungsjahre Kaiser Wilhelm II* (Berlin, 1913), 284–6.