



Human Development Report 2006

Human Development Report Office
OCCASIONAL PAPER

Mortality, Morbidity and Improvements in Water and Sanitation: Some Lessons from English History

Helen Bryer

2006/35

Mortality, Morbidity and Improvements in Water and Sanitation – some lessons from English history

Improved water and sanitation were critical factors in the falling mortality rates of the later nineteenth century. These reforms saw the number of deaths from typhoid drop rapidly, and the last cholera epidemic in 1866. Alongside and contributing to better personal hygiene and cleaner houses, they reduced other diseases such as typhus. The last recorded case of typhus in London was in 1905. Historians still dispute the relative importance of different factors in this decline – better nutrition, better medicine, better sanitation and so on – but the prevailing consensus is that the ‘sanitary revolution’ was central.¹

The impact of a polluted water supply can be seen in data collected by the eminent statistician, William Farr, showing the dramatic difference in rates of death caused by cholera between the East and West Ends of London. The West Enders were supplied with relatively clean water from upstream, while the East End supplies, drawn from downstream, were heavily contaminated with sewage and other pollution.

Deaths by Cholera by 10,000 living	1849	1853-4	1866
All London average	62	46	18
East End			
Bermondsey	161	179	6
St George, Southwark	164	121	1
Newington	144	112	3
Rotherhithe	205	165	9
West End			
Kensington	24	38	4
St George, Hanover Square	18	33	2
St Martin-in-the-Fields	37	20	5
St James, Westminster	16	142	5

²

Cholera is transmitted in drinking water and food contaminated by faeces of an infected person. Therefore (before effective immunisation was available in the 1920s) it could only have been reduced by improved sanitation, and the availability of clean water for drinking, cooking and for purposes of personal and domestic hygiene.

The incidence of typhoid fell dramatically as soon as sewers were built, from 1.2 deaths per 1000 living in 1847-50 to 0.07 in 1906-1910.

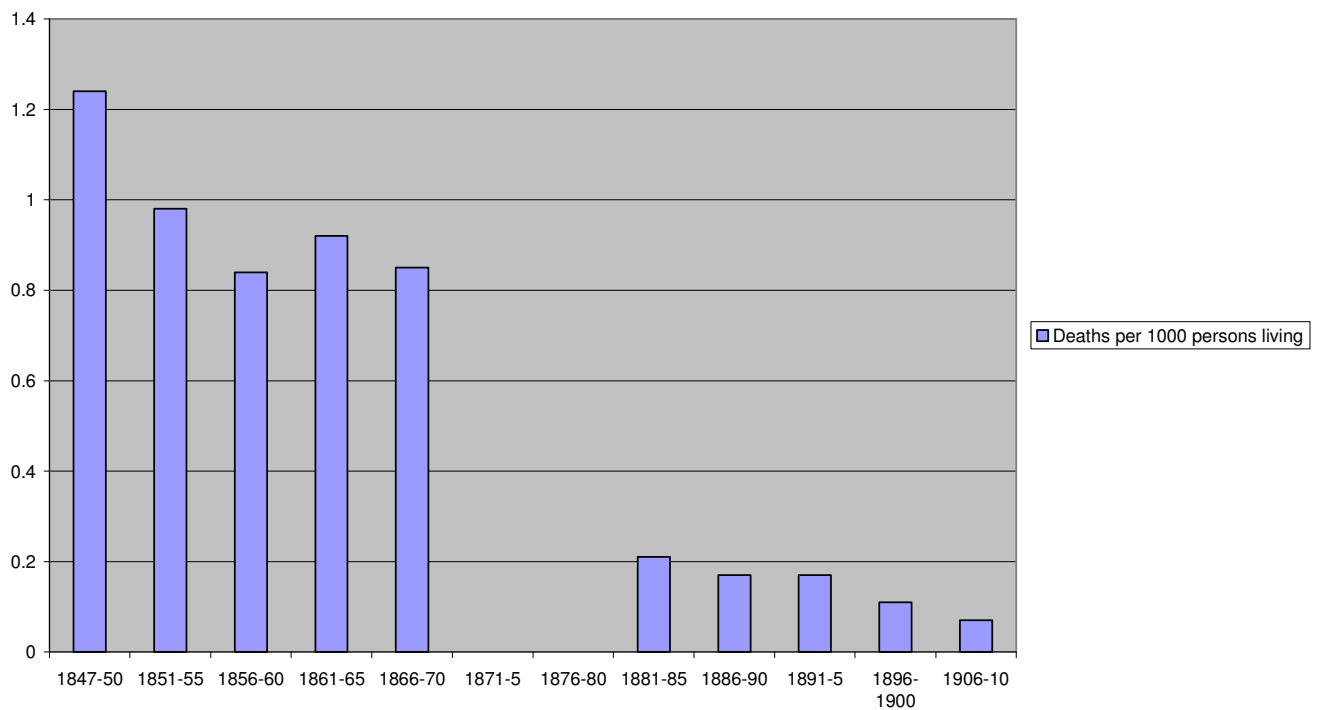
Typhoid, typhus and 'pyrexia'	
	Deaths per 1000
Year	persons living
1847-50	1.24

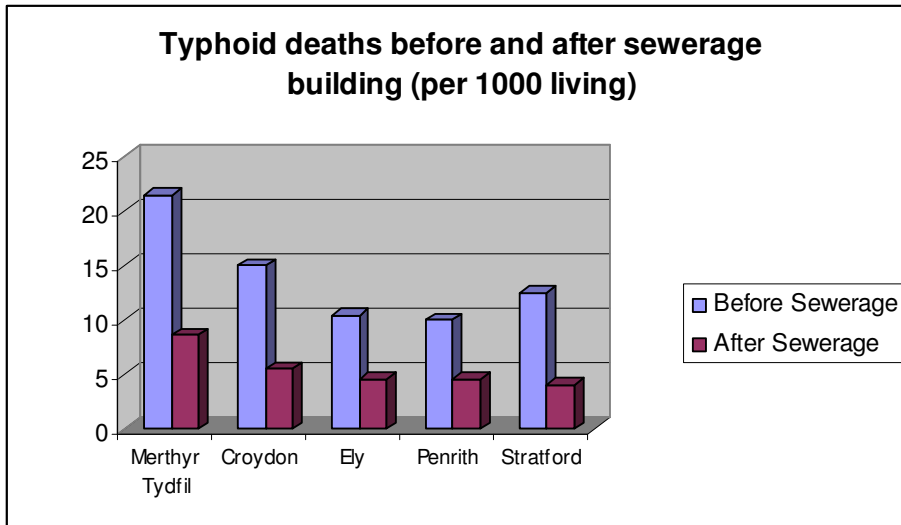
¹ For emphasis on nutrition see ..., on public action see Szreter. Useful summary of impact of sanitation on disease, see Smith 1979, chapter 4

² Farr 384?

1851-55		0.98
1856-60		0.84
1861-65		0.92
1866-70		0.85
1871-5	No data	
1876-80	No data	
1881-85		0.21
1886-90		0.17
1891-5		0.17
1896-1900		0.11
1906-10		0.07

Typhoid: England and Wales Deaths per 1000 Persons Living





3

Typhoid deaths before and after sewerage building (per 1000 living)

	Before Sewerage	After Sewerage
Merthyr Tydfil	21.5	8.6
Croydon	15	5.5
Ely	10.4	4.5
Penrith	10	4.5
Stratford	12.5	4

4

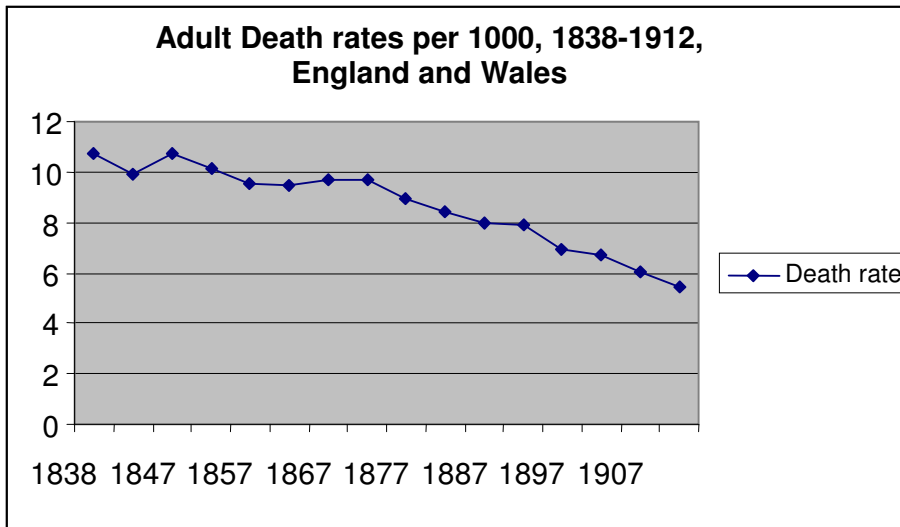
These figures are particularly striking, demonstrating particularly clearly the impact of the new sewerage systems.

Gastro-intestinal disease mortalities remained high into the early twentieth century, but these were reliant on a whole range of, as yet not fully agreed or understood, social, nutritional and institutional factors, not just the state of the water supplies.⁵

³ Smith 1979 245

⁴ Smith 1979 245

⁵ Hassan 1985 544



Adult death rates fell dramatically over this period, in large part due to sanitary reform.⁶

Infant and Child Morbidity and Mortality

Infant mortality in Britain did not substantially decrease in the nineteenth century, it even rose between the 1880s and 1890s, before falling steeply after 1900.⁷ In 1881 infant deaths made up over 25% of total mortality rates; by 1931 this percentage had dropped to less than 5% due to changing fertility and mortality rates. However, these figures were subject to variation: infant mortality in London rose less markedly from the 1880s, because many middle class districts saw no increase in infant mortality, and these made up a growing proportion of the total London population. The shift was much more marked in other urban areas like Birmingham, and in certain parts of London such as the East End.

Infants were far more affected than adults by endemic diarrhoea, rather than the epidemics of cholera and typhoid that were more successfully tackled by improved sanitation in the nineteenth century. McKeown, Record and Turner estimated that between 1900 and 1971, 26.5% of male infant and 26.2% of female infant deaths were caused by diarrhoea and dysentery. Woods states that “there seems little doubt that the increase in infant mortality during the 1890s, especially the late 1890s, was, indeed, caused by an increase in mortality from diarrhoeal diseases.” Up to a quarter of all infant deaths in England and Wales in 1899 were ascribed to this group of diseases (one-third in Birmingham), but only one-tenth were so allocated in 1880 and 1920.⁸ Woods et al. also demonstrate the coincidence of dry and hot summers during the late 1890s, which “appear to have been sufficient, given the nature of the urban environment, to have increased the infant mortality rate from diarrhoea”. In other

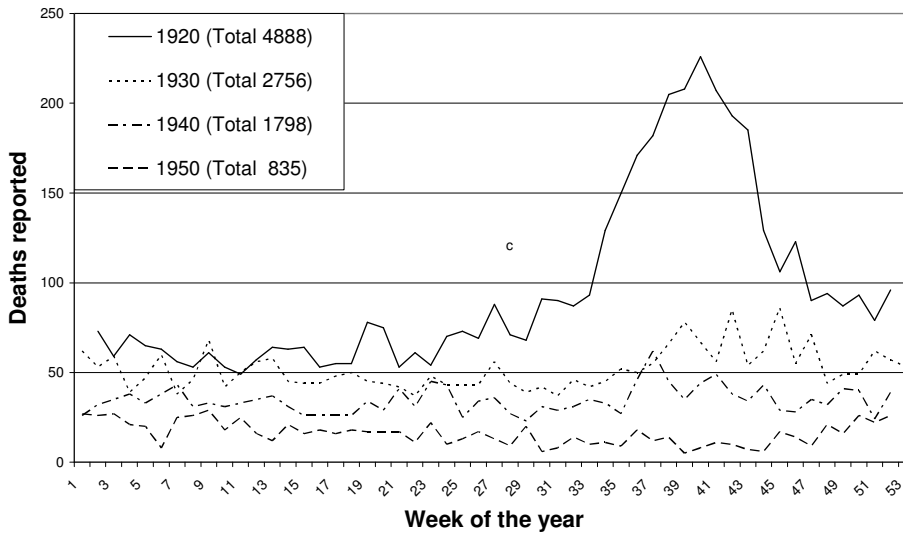
⁶ Infant mortality did not begin to seriously decline until c.1900, and seems to have been less influenced by sanitary reform.

⁷ This pattern was unusual in Europe. France, Belgium and possibly Italy saw decline from 1890, but with a temporary reverse in the later 1890s. Records from Sweden, the Netherlands, and to a lesser degree Prussia, show decline from 1881, although with a peak in 1900.⁷ Woods et al suggest the overall lower levels of infant mortality in England and Wales may be attributable to higher rates of breastfeeding, particularly amongst working-class mothers.⁷ The slower rate of decline appears to have been due, at least in part, to the far higher levels of urbanisation in England and Wales than elsewhere in Europe. Woods et al. 1988 Woods et al. 1989 116-117, 130

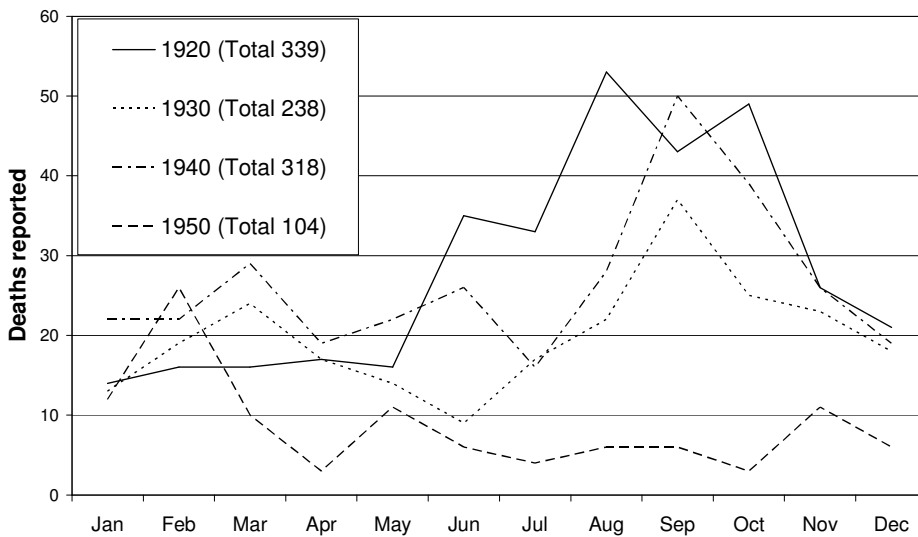
⁸ Woods et al. 1988 360

words, the improved, but still far from satisfactory, sanitary conditions in many urban areas left infants vulnerable to damaging climatic changes.⁹

Weekly diarrhoea deaths < 2 years; English towns > 50,000 pop.



Monthly diarrhoea deaths < 2 years; Glasgow



10

Many statisticians, physicians and social reformers of the 1850s and 1860s onwards took an interest in the question of infant mortality, identifying poor sanitation as a major factor in high infant mortality rates. In 1910, Sir Arthur Newsholme, Medical Officer of the Local Government Board and one of the most influential observers of his time, stated that: “thus local sanitary authorities are largely responsible for the continuance of excessive infant

⁹ For more on these and other factors in the decline of infant mortality see: Fildes 1998, Woods 1988 and 1989, Morgan 2002.

¹⁰ Sandy Cairncross

mortality, and until they fulfil satisfactorily their elementary tasks, efforts in the direction of domestic hygiene can only be partially successful".¹¹

England and France in the nineteenth century.¹²

Water and sanitation are now recognised as two of the key human development challenges of our time, yet many of the debates surrounding access to these basic services are not new. Looking back on nineteenth century England and France, we see that the gradual introduction of water and sanitation in these countries faced many of the challenges we still struggle with today. Much of the context is different, but much of the discussion and action of those reforms is highly illuminating for similar work today. Understanding what problems were tackled, what motivated these changes and the obstacles that had to be overcome, adds a different and supplementary perspective on current debates.

In the early nineteenth century, the poor of England and France had very limited access to water; their supplies were inadequate, often expensive and of low quality. Meanwhile even the most basic sanitation facilities were scarce. The pollution of water supplies by sewage, and the use of water in removing waste, particularly in a large urban context, linked the two issues closely in the history of nineteenth century England and France.

By the early twentieth century, most people in England had access to clean, safe water, in adequate quantities, and by the mid-twentieth century access was almost universal. In London, by 1887, even the poorest parish in the borough of Southwark had filtered water piped to every house, every WC had a water connection and was properly sealed, as were drains to every house.¹³

Change in France was slower, but was also complete by later in the twentieth century. Improvements had to be made because conditions were getting worse, and a link had been shown between insanitary conditions, lack of water, and disease. The poor were suffering, and even the middle and upper classes could not always escape the water borne diseases or the stink of sewage that sometimes dominated London or Paris. Above all, the powerful feared social and political unrest and 'moral decay'. A great water supply and sewerage system could enhance a nation's prestige, as modernity was increasingly associated with cleanliness and hygiene, as well as grand engineering schemes. A notable difference between the two countries was in the implementation of the schemes. In Britain, water supplies were often introduced by private companies, but by the end of the century, almost all municipalities had taken control of their own water supplies and sewerage systems. In France, on the other hand, private companies supplied, and continued to supply, most of the nation's water, through state-owned infrastructure.

Sanitation and water: conditions in the early nineteenth century

Inaccessible and expensive water

¹¹ Woods et al 1989 114

¹² England not Britain because Scotland and Ireland were legislated for and organised separately, while none of the evidence used here specifically comes from Wales.

¹³ Charlton and Murphy 1997

In the early nineteenth century, the poor lacked access to clean, affordable water, although the rich and middle classes increasingly had private or at least clean supplies. In large English and French cities, the poor mostly bought water from private vendors, or got it from pumps, wells or rivers, for which they also often had to pay. The very poor were forced to beg or steal water.¹⁴

In Leeds, most people relied on wells, boreholes, water-carriers or the river; water-carriers charged up to 2 shillings a week, which was almost as much as many people paid in rent.¹⁵ In Liverpool, water was so scarce, begging for it was common.¹⁶ In the city of Oxford, some people had to go 300 yards or more to get water, while others begged water from neighbours with 'city water laid on in their houses'.¹⁷ In Bristol, in 1845, 13,443 people were using wells that were at risk from 'cesspool soakage', water from which was delivered to the poor in many parts of the city at expensive rates.¹⁸ The first fountain in London with free, filtered water was established at St Sepulchre's in 1859 and drew 7000 people daily, demonstrating the huge demand for such facilities.¹⁹ In rural areas, the poor continued to draw most of their water from rivers, springs, ponds or wells.

In France, water supplies were also limited in quantity, reliability and accessibility, and sanitation was rare, but circumstances did not improve dramatically until well into the twentieth century.

The conditions for workers were described by Jacques Valdour in his 1921 book 'La Vie Ouvrière'. The worker's twenty four hour water supply was stored in his basin and pitcher, and as it was cold and there was little of it, he could not wash the grease off his hands after work, let alone ensure his home was clean and hygienic.²⁰

Conditions in the slums around Paris were particularly bad:

In the early twentieth century, the population of Paris continued to grow rapidly, and the poor were being removed from the terrible conditions of some of the poorest districts in the centre of Paris. Suburban settlements began to develop, as landowners sold plots of land at modest weekly rates. However, these new settlements were often compared to the urban slums these people had left, and they lacked proper water supplies or sanitation. Residents often had to walk 50 to 100 yards and queue for water, others had wells, but these were polluted by the proximity to poorly constructed latrines, and epidemics were common.²¹ The 'zone non aedificandi', known simply as 'the zone' was a shanty town on the edge of Paris, with a population of about 42,000 by 1926. In such areas, there was very limited access to water, and there were almost no sanitation facilities.²² As late as the 1960s the poorest were still living in shanty towns around Paris, with no guarantee of access to water or sanitation (these shanty towns were officially declared gone in 1971).²³

¹⁴ Bakker 2003 50

¹⁵ Sellers 1997

¹⁶ Hassan 1998 11

¹⁷ Child 1866 4

¹⁸ Hassan 1998 11

¹⁹ Hassan 1998 11

²⁰ Jacques Valdour, *La Vie Ouvrière*, 1921 in Evenson 1979 213

²¹ Evenson 1979 230-2

²² Evenson 1979 208

²³ Evenson 1979 232

Water was difficult to access and afford, particularly for the most vulnerable in society. Yet water was not just difficult to access; the liquid that was found or purchased was often polluted with sewage, domestic refuse, industrial pollution or agricultural runoff.

Low quality water

The quality of water deteriorated swiftly in the nineteenth century, particularly in urban areas, as growing populations and hugely expanded industry polluted waterways, groundwater resources and even water pipes themselves.

In 1844, an expert found that barely 10% of water from Paris fountains was drinkable.²⁴ In Bolton, in the early nineteenth century, the local authority provided water free of charge to the poor, but it was ‘of a nasty green colour’, polluted by agricultural run-off, and was fit only for street cleaning.²⁵ In Oxford, in the poorer districts where houses were more cramped, cesspools and wells were inevitably closer together and more pollution and disease resulted.²⁶ For many residents in Leeds, the River Aire was their only source of water, considering the expense of water carriers. Yet by 1830 the river was so polluted it could barely be drunk. It was described by Charles Fowler in the 'Leeds Intelligencer' in August 1841:

...charged with the contents of about 200 water closets and similar places, a great number of common drains, the drainings from dunghills, the Infirmary (dead leeches, poultices for patients, etc), slaughter houses, chemical soap, gas, dung, dyehouses and manufacturies, spent blue and black dye, pig manure, old urine wash, with all sorts of decomposed animal and vegetable substances from an extent of drainage between Armley Mills to the Kings Mill amounting to about 30,000,000 gallons per annum of the mass of filth with which the river is loaded.²⁷

This pollution was in a large part owing to the lack of proper sanitation and sewerage systems. Leaking cesspools polluted groundwater, while untreated sewage polluted rivers and streams.

Poor sanitation

Sanitation facilities were basic or non-existent for the poor in England and France in the early nineteenth century, and for many, were still lacking by the last quarter of the century. This resulted in dirty living conditions, dirty water and disease. Blocked sewers (originally designed to drain rainwater, not the household waste they now carried) were also a problem, releasing unpleasant, even poisonous gases – known as ‘sewer gas’ - like methane. These caused health problems when they leaked into the houses above, homes of the rich or poor (although servants living in the basements of wealthy households often felt the worst effects of the fumes).²⁸

²⁴ Goubert 1989 41-2

²⁵ Hassan 1998 11

²⁶ Child 1866 6

²⁷ Sellers 1997

²⁸ Sellers 1997

A Parisian physician, O. Du Mesnil, described the *garnis* (furnished apartments where many of the poor lived) of the 1870s:

a great number of the buildings containing *garnis* are in the most deplorable state from the standpoint of hygiene; the humidity is constant, ventilation and lighting insufficient, the dirtiness sordid....; the privies, when they exist, are insufficient in number; their filthiness is revolting.²⁹

At this time, conditions were particularly bad in squatter settlements on the outskirts of Paris. One was actually described as “a sort of open-air sewer”³⁰

In Leeds, a local doctor, Robert Baker, wrote:

The surface of these streets is considerably elevated by accumulated ashes and filth, untouched by any scavenger; they form the nuclei of disease exhaled from a thousand sources. Here and there stagnant water, and channels so offensive that they have been declared to be unbearable, lie under the doorways of the uncomplaining poor; and privies so laden with ashes and excrementitious matter, as to be unuseable, prevail, till the streets themselves become offensive from deposits of this description: in short there is generally pervading these localities a want of the common conveniences of life.³¹

Disease

The inevitable results of these conditions were disease and death. Water borne diseases, primarily cholera, typhoid and gastro-intestinal diseases like diarrhoea, were major killers in the nineteenth century. Further disease, such as typhus, could be the result of a lack of personal hygiene and unsanitary, crowded living conditions. Their causes were debated, but common solutions were suggested, namely the improvement of water supplies and sewerage facilities.

Cholera first struck Britain in 1831, followed by a number of subsequent epidemics. In 1831-2, over 31,000 deaths were ascribed to ‘cholera and diarrhoea’, in 1848-9 about 62,000, in 1853-4 about 31,000 and in 1866 about 15,000.³² These epidemics were swift and frightening, although they did not usually last long.³³ It also hit the poor hardest. In London, the victims of the 1832 cholera epidemic were mostly the poor of the East End, while the middle and upper classes escaped.

France and much of the rest of Europe were still worse hit. The 1832 Cholera epidemic killed 20,000 in Paris, mainly in the slums. In one week, 5,523, were killed - more than in London in the whole year (5,275).³⁴ As conditions elsewhere in Paris improved, epidemics were increasingly confined to the poorest districts of the city. A cholera epidemic in 1884 killed 989, almost exclusively in the slum quarters. In 1892, another cholera epidemic took 906, mostly in the eleventh, eighteenth and nineteenth Arrondissements: all working class areas.³⁵ The severity of a typhoid epidemic in 1882

²⁹ O. Du Mesnil “Les garnis insalubres de la ville de Paris, Rapport à la commission des logements insalubres” *Annales d’hygiène publique et de médecine légale*, January-June 1878, pp.193-232.

³⁰ *Rapport general sur les travaux de la Commission des Logements Insalubres pendant les Années 1877 à 1883*, 164-171, in Evenson 1979 205

³¹ Sellers 1997

³² Smith 1979 230

³³ Chadwick 1842 Intro: 8-10

³⁴ Smith 1979 237

³⁵ Evenson 1979 208

frightened city authorities in Paris, who finally addressed the question of sewage disposal.³⁶

Conditions were worsening, particularly in cities, as industry grew and populations exploded. Traditional sources of water were destroyed, as rivers and underground sources were polluted (by sewage and industrial waste), and springs were covered over and built on. Water shortages and growing levels of pollution were the inevitable result. However, conditions alone do not determine action; different societies, at different times, have different levels of tolerance of certain conditions. The key questions to ask regard what spurred change: why did reformers take up this issue, and why were the changes made that were?

What prompted public action?

Public action was spurred by an awareness of worsening conditions, a fear that this was leading to ‘moral decay’ and social and political unrest. The middle classes were also scared of putting themselves at risk of disease. Public health was then increasingly seen as requiring urgent attention, and local and central government grew to see it as their responsibility.

Investigative reports

Reports, primarily written in the late 1820s, 1830s and 1840s, raised the question of water and sanitation, outlining the potential impact in terms of disease, and wider social, economic, and political change, of failing to deal with the problem. The committed individuals, reformers and physicians who wrote these reports played an important role in bringing the plight of the poor to public and government attention. Yet in the early decades of the century reports were largely ignored. In England, a Government commission was established in 1827 to report on London’s water supply, but their 1828 report was widely disregarded.³⁷

Other reports, however, received far more attention. In France, A.J.P. Parent-Duchâtelet and Louis René Villermé wrote much on the appalling sanitary conditions in the 1820s and 1830s. Both were editors of the *Annales d’Hygiène*, the first journal committed to public health, established in 1829, which published many such findings. A number of societies were also established, such as the Société Française d’Hygiène and the Société de Médecine Publique et d’Hygiène Professionnelle de Paris, both founded in 1877, which raised awareness and discussed possible solutions to the crisis.³⁸ However, in France public health remained primarily an academic concern. From 1820 local doctors had to report to the Royal Academy of Paris which then printed the statistics in the *Annales d’Hygiène Publique et Médecine Légale*. Yet, this academic pursuit was not used to spur integration of questions of public health into public policy, legislation or practice.³⁹

By far the most famous report in England was Edwin Chadwick’s 1842 *Report on the Sanitary Condition of the Labouring Population of Great Britain*. Chadwick had been influenced in his work by Parent-Duchâtelet and Villermé, but also wished to

³⁶ Goubert 1989 199

³⁷ Barty-King 1992 91

³⁸ Evenson 1979 211

³⁹ <http://www.strath.ac.uk/Departments/History/barton/ds10.htm>

implement his findings. Chadwick pursued his report against the wishes of many of his superiors in the Poor Law Commission, who feared he would antagonise powerful interests.⁴⁰ He published it in his own name when the government refused to do so, and it was a bestseller.

Such reports are often credited with bringing about the introduction of water supplies, sanitation and widespread improvements in public health. Indeed, they played a vital role, but these reports were responding to and building upon other changes in society, science and politics. Many of the issues, fears and suggestions raised in these reports are outlined in the following pages: the threat of disease was explicitly linked to sanitation and middle classes were warned that they, too, were vulnerable. Above all, Chadwick played on the social, political, economic and 'moral' risks of ignoring the problem.

Disease

Chadwick and other reformers argued persistently for the need for improved sanitation to prevent the spread of disease. They believed disease was spread by 'miasmas' in the air, through 'foul odours' from sewage and other dirt, in line with dominant [epidemiological](#) thinking of the day. Chadwick's call for a better water supply was chiefly as the best means to clear away the waste and filth, rather than to ensure a supply of safe drinking water (for him, a secondary consideration).

Others proposed what became known as the 'germ theory'. From 1854, John Snow argued that cholera and typhoid were actually water borne diseases. His priority was therefore to ensure a safe supply of drinking water; a key part of this would be to ensure decent sanitation facilities to prevent contamination of water supplies by sewage. Despite disagreement, therefore, on the causes of disease, both could agree that a decent water supply and improved sanitation facilities were essential for public health.⁴¹

The impact of these findings varied. These diseases were feared, and just the threat of an outbreak sometimes spurred action, particularly new legislation. Epidemics were, however, relatively short-lived, so did not always result in sustained in substantial change.

In Paris, medical committees were established after the 1832 cholera epidemic and some mayors took a greater interest in hygiene, sewage disposal, cesspits and wells, but this interest was often fairly short-lived.⁴² The 1892 typhoid epidemic, on the other hand, did lead to systematic analysis of water, and contributed to the recognition of the need for a universal water supply.⁴³

It became clear that water and sanitation were central to improving public health in French and British cities. The desire to improve public health can be attributed to a range of factors, including the genuine concern of reformers, government officials and others for the suffering of the poor. Alongside this desire to combat suffering were fears that such diseases could also affect the middle and upper classes, as could the foul smells drifting from the incredibly polluted rivers, particularly the Thames in

⁴⁰ Hamlin 85

⁴¹ Goubert 1989 46

⁴² Goubert 1989 6

⁴³ Goubert 1989 4

1858. There were also evident social, political, economic and even moral implications of such widespread suffering and high morbidity and mortality rates.

Disease: crossing social boundaries

Across Europe, disease hit the poorest hardest. But there were middle and upper class victims as well.

In York, Newcastle, Leeds and elsewhere, there were also a number of middle class victims.⁴⁴ Typhoid also attacked the middle classes as well as the poor; indeed, it was believed that Prince Albert's death in 1861 was due to typhoid.⁴⁵ Most famously, 'The Great Stink' of 1858 recognised no social distinctions. Gladstone and his Parliament were famously forced out of Westminster by the overwhelming stench from the polluted river. With a belief in the dangers of 'miasmas' and 'foul air' still widespread, such fumes were also feared as a potential source of disease. London had already begun to develop sanitation systems, but was greatly spurred on by these circumstances. Great new sewers, feats of modern engineering, relocated the pollution downstream, nearer estuarine towns, but well away from London.

Many of the local health inspectors reportedly used 'disease' as a 'trump card' to scare complacent middle classes into action.⁴⁶ The physician Thomas Southwood Smith, who had written a report on sanitary conditions in 1838, argued that 'wretched' people, with 'enfeebled' constitutions would succumb to disease more easily, but that poison (which he believed carried in the air) would eventually spread to "the most remote streets and great squares of London".⁴⁷

The French elites were no more immune than the British, although they also suffered far less than their poorer compatriots. Norma Evenson, historian, wrote of France that, "in the view of some observers, it was primarily the fear that disease might spread from slum quarters to middle class districts, that motivated general public and government concern for improving housing conditions"⁴⁸ As late as 1921, cases of bubonic plague occurred in 'îlot 9' (of the seventeen 'îlots insalubres' identified in 1919). Fear of a widespread epidemic caused swift action, which had been planned for years but never implemented, and the area was soon redeveloped.⁴⁹

Economic risks

Chadwick and some other reformers emphasised the economic cost to the nation of the public health implications of bad water and sanitation. The costs of caring for the sick were high and, above all, universal access was imperative if Britain was to retain a functioning workforce. Chadwick's main criticism of the necessity for the poor to queue for water was that this constituted a waste of potentially productive time.

Poor water quality also had implications for industry. By the mid-nineteenth century, river water was often so polluted that it was 'utterly unsuitable' for manufacturing, so

⁴⁴ Barty-King 1992, 98; Sellers 1997

⁴⁵ Hassan 1998 20

⁴⁶ Hamlin 1998 295

⁴⁷ Hamlin 1998 118-9

⁴⁸ Evenson 1979 208

⁴⁹ Evenson 1979 216

demands emerged from powerful industrial interests for a substantial and reliable supply of clean water.⁵⁰

‘Moral’ costs

Many reformers, particularly in the 1830s, argued that poor conditions were having a highly detrimental effect on the functioning of society, and in particular on the morals of the poor.⁵¹ Chadwick’s report focused more on such concerns than directly on disease; he linked poor sanitary conditions to such questions as illegitimacy, crime, labour unions, sedition and family values. Many reformers wanted to prevent the poor having to queue for water, not because of the effort and discomfort it cost those people, but due to the bad language, gossip, bickering and crude, even obscene, behaviour that took place in such queues, especially amongst girls, and even with children close by.⁵²

Social and political costs

Many reformers, not least Chadwick, saw the need for universal sanitary provision more in terms of discipline of the ‘labouring and dangerous classes’ than in terms of their dignity and liberty. The 1830s and 1840s were a time of social discontent and political unrest across Europe. In London, the 1832 cholera epidemic had sparked discontent among working class radicals: the National Union of the Working Classes organised a demonstration of 120,000 in London to protest the Government’s inaction. It was also feared that the Kennington Common and other Chartist demonstrations of 1848 were in part spurred on by the cholera epidemic of 1847-8.

Yet pressure for reform on these grounds did not so much come from below, as from middle class reformers. They saw it as a relatively uncontroversial and straightforward way to improve the conditions of the poor, to reduce social and political tensions, without giving in on wages, labour, food, and other far more politically charged issues.⁵³ The emphasis in Chadwick’s report on the impact of poor sanitary conditions on the ‘dangerous classes’ was in part a response to contemporary government fears. In 1841 the new Home Secretary, Sir James Graham, predicted violence within the year (which indeed erupted in the plug riots in August 1842); fears which he communicated to Chadwick. To many “class war seemed imminent”.⁵⁴ In this context, the social and political, as well as the moral dangers, of not acting to improve sanitary conditions, became a dominant theme in the *Sanitary Report*.

Likewise, in Paris reformers explicitly linked insanitary conditions to immorality, discontent and social instability as late as 1906.⁵⁵

Prestige and modernity

The goal of ‘progress’ and modernisation, so powerful in the mid-nineteenth century, came to include water supply, drainage, sunlight, clean air, and other changing

⁵⁰ Hassan 1998 20

⁵¹ Bakker 2003 51; This was in some ways a radical argument, in its contrast to old concepts of the ‘undeserving’ poor - it suggested that the low moral standards of many poor people were a consequence of their poverty, not a cause of it; Hamlin 1998 84-5

⁵² Hamlin 164

⁵³ Hamlin 1998 13

⁵⁴ Hamlin 1998 185

⁵⁵ Ferrand, *Habitation à bon marché* in Evenson 1979 210

notions of hygiene. By the 1850s in England, public health was seen as noble cause. Moreover, the great engineering schemes of Paris and London, the construction of water supply networks and sewers, were tangible achievements, demonstrating the cities' wealth and success, as well as their commitment to the needs of their citizens. In other towns and cities, in both countries, progress was slower, but the desire to boost a town's prestige was often a factor in the building of such new systems.⁵⁶

In Rennes, in 1882, the mayor and municipal council built the town's first water supply system, partly as a relatively straightforward way to show tax payers their money was well spent and also to win the town, and its council, prestige.⁵⁷ These schemes did not always initially include working class districts, particularly in France, but gradually universal provision came to be seen as a prerequisite for a 'civilised' nation.⁵⁸ In Britain, sanitation was a particular issue of prestige for urban elites, many of whom saw urban-social reform as their responsibility.⁵⁹ Municipal achievements could be a great cause for civic pride.

Attitudes to hygiene and water

The nineteenth century saw a shift in attitude towards hygiene and cleanliness. Personal hygiene was of growing interest to the upper classes in the eighteenth century and also to the middle class in the nineteenth. Personal bathing, previously associated with pagan rites and immorality, came instead to be seen as central to physical and moral health. Likewise, as cities grew and conditions worsened, human waste lost its earlier rural associations with fertility and was increasingly seen as a sign of disorder and decay.

By the mid-nineteenth century in Britain, the importance of hygiene and cleanliness was being emphasised to the poor, but there was little the poor could do without a decent water supply. Reformers emphasised that without a better water supply, the poor could not be expected to improve themselves. This, in the age of self-improvement and 'self-help', was a fairly powerful argument and helped reformers win support for the idea of a universal water supply.

In France, attitudes changed more slowly. There was an increased interest in hygiene and water supply amongst monarchs, aristocracy, and the middle classes from the end of eighteenth century. Indeed, France was said to "set the international pace in matters of hygiene" in legislation, education, periodicals, medicine.⁶⁰ And there was a growing demand for clean water, particularly among certain anglophiles, who were convinced France should follow England in its increased and better quality water supply. However, this supply was to be for them, the wealthy and powerful, they were not suggesting the need for universal supplies. Nor, initially at least, was much interest shown in the need for universal hygiene and sanitation. Although from the 1830s, the notion of public health began to integrate the issue of water supply with wider questions of sanitation; cleanliness of towns, bodily hygiene, domestic habits,

⁵⁶ Hassan warns us not to overestimate this factor, putting more emphasis on the self-interest on the part of the propertied and commercial classes, Hassan 1985 538

⁵⁷ Goubert 1989 199

⁵⁸ Goubert 1989 103

⁵⁹ Kaika 2005 79

⁶⁰ Goubert 1989 104

poverty and disease, this idea did not attract much attention.⁶¹ It was not until the late nineteenth century, from about 1880, that a gradual shift in attitude could be seen in France, from an assumption that water was the privilege of the nobility, to the sense that it was the property of all, an industrial product. A great suspicion of bathing and the need for personal hygiene existed and had to be overcome. In France, from 1880 a programme of social and health education was run by the press and through state schools, to show the working and middle classes the benefits of using and paying for clean water.⁶²

Increasing demand

In the eighteenth, and well into the nineteenth or even twentieth centuries in many areas, water had been an 'artisanal' product, collected from rivers, wells and springs. Urbanisation and industrialisation, however, required far greater quantities of water than were made available through these means. Through the nineteenth century, water became a mass produced 'industrial' product, both economically viable and necessary, due to greater, and more concentrated, demand.⁶³

Greater demand led to better supplies, but was also a response to them, as people saw the possibility of, and opportunity for, greater access. In the early nineteenth century, seven litres a day was seen as adequate to meet the needs of Parisians; at the same time, twenty litres per day was already seen as the minimum in Britain, or even thirty, when street cleaning and washing linen were understood as necessities. By 1846, a bylaw in Paris was stating that domestic requirements needed over a hundred litres a day.⁶⁴ This demand was not, however, being met, and it raised questions about existing water supply systems.

The greater demand from industry (especially textiles) for a better water supply does not explain efforts to bring water to the poor, but it did add pressure to wider demands for better supplies, and for less polluted sources. These demands increased in the second half of the century and approximately one third of water supplies were generally used by industry in industrial towns. Sometimes this percentage was as high as 42.8%, as in Wakefield, or even 59.1% in Leeds.

Legislation and implementation

In this section, England and France will be addressed separately, in order to explore the different development of the two systems.

ENGLAND

Water and sanitation systems first developed for the use of the middle and upper classes, who wanted clean water for drinking, personal hygiene and other domestic purposes. By the early nineteenth century, there was an increasing demand from industry, as more water was needed and supplies were diminishing. The most radical shift, towards the middle and latter half of the century, was then in the extension of water provision to the poor. Reforms were strongly debated, and the results were not universally popular; in fact they met with considerable resentment in various sectors

⁶¹ Goubert 1989 47

⁶² Goubert 1989 23

⁶³ Bakker 2003 44; Hassan 1998 16

⁶⁴ Goubert 1989 51

of society. Attempts to legislate on this question were particularly challenged by property owners fearful of any perceived infringement of their property rights. Yet local authorities brought in more reforms and new supply systems, and legislation was gradually introduced.

Water and sanitation provision was established fairly haphazardly by a range of local providers. Central government gave these providers permission to undertake sanitary reform, initially through local acts, and eventually, in 1848, through general legislation, but no rigid legislative framework was in place to enforce universal provision until...

By the end of the century universal access was almost implemented, and the idea was certainly widely accepted.

Even at the heights of the 'age of laissez faire', many felt that legislation and regulation was required in the area of water and sanitation. It was argued that to leave these issues to the market would be 'not humane' and 'not safe'.⁶⁵ So legislation and regulation were slowly introduced:

Local Acts of Parliament and local providers

Before 1848, a potential supplier, wanting to establish a water supply or sanitation facilities, required authorisation through a Local Act of Parliament, based on a private members bill. This could theoretically be obtained by anyone, but was always applied for by groups not individuals: 'improvement societies', private enterprises, communities, or municipal authorities. Costs were high, leases long and providers would not be able to meet these costs if forced to share the market, meaning that the most efficient way to supply water was through one of these single providers with a monopoly on provision.⁶⁶

'Improvement' commissions

From the mid eighteenth century, water and sanitation had been gradually introduced by, and for, the middle class, primarily through local 'improvement' commissions, generally part of local authorities. The reforms they introduced made Georgian squares clean and elegant, with flourishing gardens. The rich could live in better health and greater comfort, yet the poor saw little benefit from these reforms, which rarely left the main streets to reach poorer districts.

Moreover, the effectiveness of such societies was diminishing in the second quarter of the century. From the 1840s, municipal corporations and other local authorities began to overtake the improvement societies as providers of such reforms.

Private companies

Private companies had been involved in the provision of water in the seventeenth and eighteenth centuries, and became increasingly involved in the early nineteenth century.⁶⁷ Parliament often showed a preference, at this time, for private providers. In Manchester, in 1808-9, local groups led by businessmen and politicians tried to maintain collective control of the town's water supply, yet Parliament approved the

⁶⁵ Hamlin 1998 251, quoting from the Health of Towns Association 'Abstract of the Public Meeting'.

⁶⁶ Hamlin 1998 259

⁶⁷ Bakker 2003 48

proposal of a private company to take over supply.⁶⁸ Moreover, it has been suggested that many politicians favoured private water companies due to their own financial involvement in such enterprises.⁶⁹

The number of larger provincial towns served by joint stock enterprise increased from 26% in 1831 to 54% in 1851.⁷⁰ However, by about 1840, it was already beginning to be evident that private enterprise was, in many ways, ill-suited to the provision of the water supply for late nineteenth century England and Wales. Hassan states “by the 1840s what may be described as the brief British experiment with *laissez-faire* in the water industry was beginning to be recognized as a failure”.⁷¹

Municipal authorities

Municipal authorities, with a long tradition of involvement in public water provision, had largely given up these powers by the end of the eighteenth century.⁷² Communal water administration had decayed and to many, authorising private companies to supply water seemed the best option available in the early decades of the nineteenth century.

Some local acts did give municipalities control. The Leeds Improvement Act, for example, passed by Parliament in 1842, gave the City Council the power to construct common sewers and to carry out other drainage works. The Council was also empowered to ensure that no house could be built until its site was drained, and that the owner or occupier of any house near to a Council sewer, had to connect to that sewer. However, municipalities generally lacked the resources and influence to lobby for a private members bill, giving private companies a distinct advantage in competing for the right to supply water.

General legislation and new public bodies (1840+)

The central authorities began to take a real interest in water and sanitation provision from the early 1840s, particularly following the publication of Chadwick’s report in 1842. From then on a succession of public bodies was established to debate, facilitate and administer the establishment of water supplies and sewerage systems and ensure access to those networks. Some of this was done at central level, much at local level. The complex interaction between the two levels, part of a far wider story of mid-Victorian politics, cannot be fully explored here. The key bodies and pieces of legislation involved are, however, outlined below. The different bodies varied greatly in nature, powers and aims, but all shared a common goal of increasing access to water and sanitation. Two examples of powerful bodies formed to address public health in the 1840s were the Royal Commission on the Health of Towns and Populous districts, formed in 1843, and the Health of Towns Association, formed in 1844. Both made a significant contribution to the development of public health and the passing of a number of pieces of national legislation later in the decade.

Royal Commission on the Health of Towns and Populous districts 1843

⁶⁸ Hassan, 1985 533

⁶⁹ Stern 1954 quoted in Hassan 1985 533-4

⁷⁰ Hassan 1998 16

⁷¹ Hassan 1985 534

⁷² Bakker 2003 48

This Commission was convened swiftly, following the publication of Chadwick's 1842 *Sanitary Report*, and reported in 1844 and 1845. It was a remarkable response, not to any particular epidemic, or new hygienic principle, but to Chadwick's report, and the atmosphere of social tension, particularly the winter riots of 1842-1843.

The Commission was established specifically to look at sanitation, water and housing. Its achievements were mainly technical and political rather than practical, but were not insignificant. It amassed vast quantities of data on how to build sewerage works and water supplies, and recycle sewage but it is unknown to what extent this information was actually used by surveyors, engineers and architects implementing such projects. Politically, its investigations raised levels of interest in sanitation. It has been stated that the Commission, "much more than the Sanitary Report, launched the sanitary movement of the mid-1840s". Its recommendations also defined many of the aims of that movement: the involvement of central government to ensure 'uniformity of practice'; management by local authorities, but central government could interfere if works were not carried out fast enough or when problems were particularly severe. Local authorities were to enforce regulations on sewerage, were not required to supply water, but could acquire company-owned water works and own sewage and other recyclable rubbish.⁷³

This commission did not enforce changes to the implementation of sanitary reform on the ground, but significantly raised the level and changed the terms of debate, really bringing public health to public attention.

Health of Towns Association, 1844-1849

The short-lived Health of Towns Association played a vital role in promoting sanitary reform, leading up to the 1848 Public Health Act. It debated many of the key questions regarding water and sanitation provision: who should provide, who should pay, who, if anyone, should regulate. Chadwick had already suggested that sanitary works be amortized over the life of the works (about thirty years) so the burden of payment was not huge, but it was still significant. The Association stated that payment must be made by the occupiers of properties, not the owners, as these were easier to identify. This was also an easier move politically (as Chadwick, who opposed the idea in 1841, later accepted). But it ignored the highly contentious ongoing debate as to whether tenants had to pay for capital improvements on the property they occupied, and broke from the tradition of local improvement legislation which assigned costs to owners, usually through an upfront fee not long term borrowing. Part of the appeal of the loan scheme was that payments could be made low enough to pass on to occupiers. In effect, this announcement treated sanitation as a service not a capital improvement.

In the range of debates it covered and its major propaganda efforts on behalf of public health, the Health of Towns Association also played a big part in bringing pressure for change.

Key Legislation

Waterworks Clauses Act 1847

⁷³ Hamlin 243

The Waterworks Act of 1847 was the first national water legislation. It was one of a series of 'clauses' acts; summaries of model clauses adapted from earlier local acts, that towns and companies could then use in their bills. It was designed to reduce the work involved for Parliament in assessing new bills, but also made such local acts easier for municipal authorities and others to put together and submit.

The Act included provision for the regulation of maximum charges and dividends of private water companies, although it included no framework to ensure access for all consumers. In fact, it stated an obligation to provide access to all, *provided* they could pay. It also prohibited the contamination of any stream or reservoir used as a public water supply, or any aqueduct or any other part of the supply system. The 1863 Waterworks Act made it an offence for owners negligently to allow pipes to fall into disrepair, wasting or contaminating the supply system.

Nuisances Removal and Disease Prevention Act 1847

This Act was passed in the expectation of a further cholera epidemic, and allowed local authorities to remove 'nuisances' found harmful to health.

Public Health Act 1848

The first Public Health Act was passed in 1848, following the cholera epidemic of 1847-8, and widespread social and political unrest. The Public Health Act:⁷⁴

- Established a central **General Board of Health**, which had influence, but little power or money. The Board had some powers to act in epidemics but its main task was to promote, facilitate and loosely supervise municipal sanitary reform. It had the right to set up Local boards of Health anywhere with a death rate over 23/1000 (or where 10% of ratepayers petitioned for its adoption). These boards would have the powers previously only attained through a private members bill, to supply water, house drainage, sewerage and sewage treatment. However, the General Board did not often use its power to demand the establishment of such bodies.
- Reasserted much of what had already been achieved in the Waterworks and Nuisances Removal Acts; stated that corporate boroughs were to take responsibility for drainage and water supplies and occupiers would be charged for improvements, except in dwellings valued at less than 10 pounds annual rent.

Landowners and others greatly resented what they perceived as any infringement upon their rights and liberties, lobbying hard against any public body with powers to implement public health reforms. When the Board of Health was abolished, *The Times* wrote that "the English People would prefer to take the chance of Cholera, rather than be bullied into health". It also called the 1848 Act "a reckless invasion of property and liberty".⁷⁵ Such objections, although a powerful force, did not prevent the growing momentum in the implementation of sanitary reform.

Metropolitan Water Act 1852

⁷⁴ The Act applied to all England and Wales, except London. Scotland and Ireland were not included in the Act.

⁷⁵ Sellers 1997

Banned water companies from drawing water from tidal sources, which were the most polluted.

Sanitary Act 1866

Passed following the 1865-6 cholera epidemic, this act finally enforced the connection of all houses to a new main sewer.

Public Health Act 1872

Sanitary authorities were established, and all authorities had to appoint a Medical officer of health.

Public Health Act 1875

In many ways the most significant act of all. The 1875 Act was comprehensive, consolidating all previous legislation, and, above all, its provisions were compulsory. It established the Local Government Board, with all the apparatus of a ministry and responsibility for a whole range of related issues, including sanitation. It obliged local authorities to appoint health and sanitary inspectors.⁷⁶

Administration in the latter half of the nineteenth century

All this new legislation and activity by central authorities had an impact on local administration of water and sanitation. Local authorities, however, were not just waiting for instruction from above – many had already implemented reform as we have seen, others strongly resisted change, despite pressure from central authorities. This was not just a resistance to being told what to do, or a resistance to progressive reform. Even authorities keen to implement change struggled to identify the best model and to ensure that their large investment would not be wasted. Another obstacle to municipal authorities implementing such reforms was that many supply networks were in the hands of private companies. However, a noticeable trend, following in the wake of much of this legislation, was the huge increase in municipal provision, and a corresponding decrease in the role of private companies.

Private provision had always faced a range of challenges, some of which municipal authorities did not have to deal with, not least the necessity of making a profit. The problems facing private providers combined with the increasing opportunities for and pressure on municipalities, leading to a rapid rise in municipal involvement.

Municipal takeover: 1860 onwards

Private sector provision largely offered poor service, even to the few households which were actually connected to supplies. Levels of service improved only very slowly, particularly in poor areas, which were unprofitable for the companies to invest in. By 1881, per capita supply in 66 publicly managed waterworks was 50% higher than in 14 that were still privately supplied.⁷⁷ In 1827, in London, there was enormous resentment at the quality of the water supplied by the private Grand Junction Water Company; the company's intake was only three yards from the outlet of a large foul sewer. Public outcry ensured that the pipe was extended, so water was drawn from a

⁷⁶ Hassan and Taylor 1996 5; Bakker 2003 49;

<http://dspace.dial.pipex.com/town/terrace/adw03/peel/p-health/phact.htm>; Barty-King 1992 101

Bakker 2003 44; Hassan 1998 16

⁷⁷ Hassan 1998 16, 17, 18

cleaner part of the canal, and precipitation reservoirs were built.⁷⁸ Moreover, sewerage provision was lagging behind water supply, partly because this was a less profitable area for private investment.⁷⁹ In some areas it was found that the establishment of private firms providing water was compromising municipal provision. In Bolton, for example, in 1824, the trustees of the city's fountains also became shareholders in the new water company. They neglected the municipal pumps so they could charge the poor for water.⁸⁰

The water companies faced increasing problems in making profits from provision of water. By the middle of the century most were serving their entire target market (anyone who could afford their prices) and companies were struggling to expand. In particular, in some areas direct competition was allowed, meaning some towns would have two water pipes running parallel, neither running at full capacity, limiting profits still further. Costs were also rising, due to the exhaustion of existing water supplies and ever-growing pollution. By the middle of the century many private water companies were making very little profit, some did not even declare a dividend.⁸¹

Profits were already low, but the new political consensus on the need for universal access to water, emerging in the second half of the century, threatened to make water supply an even less lucrative business. Supplying water to even the poorest districts would not be profitable for private enterprises, which preferred to focus upon customers who could afford their services. As the demand for universal access grew, many felt that the private sector could not be the right choice to introduce the new services. Reformers such as the few but influential 'gas and water socialists' of the Fabian society, argued that individuals and the private sector would not make the most of water provision. Water was a 'merit good', entailing greater benefits for society than was recognised in people's own preferences for it. It therefore required management by the state for the most to be made of the resource.⁸²

From about 1860, a growing number of municipal authorities began to take control of town water resources. Legislation of the 1840s made it easier for local authorities to regain control of waterworks, through applications to central government, although Parliament did not always grant such applications. From 1870, the Gas and Water Facilities Act ruled that municipal water 'trading' companies could be established by administrative decision not Parliamentary Bill, again facilitating municipal take over.⁸³ The whole process was financed through local government funds, local taxes, and by generous loans from central government.⁸⁴ The process was often not straightforward. Although some companies were showing such low profits they were ready for takeover, others fought to retain private ownership. There was also a complex relationship between land and water rights, and municipalities sometimes

⁷⁸ Barty-King 1992 93

⁷⁹ Bakker 2003 48

⁸⁰ Hassan 1998 17

⁸¹ Bakker 2003 51

⁸² Bakker 2003 45

⁸³ Bakker 2003 51

⁸⁴ Hassan 1998 18

paid considerable compensation to private individuals or companies who claimed rights to the water being diverted for public use.⁸⁵

In 1861, 40.8% of larger provincial towns were supplied municipally; by 1881 this figure had risen to 80.2%, and by 1901, 90.1% received a municipal water supply.⁸⁶ This also represented a considerable extension in the water supply network – i.e. they were building new supply systems, not just taking over private enterprises.⁸⁷ The Bolton water company mentioned above was taken over by the town council in 1847.⁸⁸ By the end of the nineteenth century, huge investment had made cheap water almost universally provided, at least in urban areas. It was seen as almost ‘a civic duty on the part of local government’.⁸⁹ Rural provision was slower; fewer than 40% of rural parishes had piped supplies in 1914, but provision increased rapidly over the next 30 years.

Number of Municipal Corporations adopting Municipal Water supplies: ⁹⁰

Before 1845	10
1846 - 1855	29
1856 - 1865	22
1866 - 1875	66
1876 - 1885	68
1886 - 1895	42
1896 - 1905	69
1906 - 1914	20

⁸⁵ Bakker 2003 49

⁸⁶ Hassan 1998 18

⁸⁷ Bakker 2003 20

⁸⁸ Hassan and Taylor 1996 5

⁸⁹ Hassan 1998 61

⁹⁰ Falkus quoted in Hassan 1985 534

FRANCE (Paris)

Public health in France came under a number of different departments and authorities, which made concerted action difficult. Central government paid little attention to public health for most of the nineteenth century; the issue remained of only 'theoretical interest', and water supplies could not really spread until the state took responsibility.⁹²

Most action was therefore taken by local authorities. Some Local Boards of Health, such as the Seine and Paris boards, took on considerable responsibility in investigating problems, including the lack of water and sanitation. However, these bodies were only advisory, with no powers to enforce their recommendations.

This contrasted with certain other western countries, where, at least in urban areas, government took concerted action and access to water had increased accordingly. Progress in France was far slower than in England, Germany or the USA. In 1911, 96% of dwellings in London were connected to a water supply, compared with just 17.5% in Paris. In 1895, approximately 42% of urban communities in Prussia with a population of over 2,000 had a water supply network, compared with only 25% of urban communities in France with over 3,000 residents. Likewise, regarding sanitation, Britain, the USA and Germany had considerably better sewerage systems than France by 1900, and continued to make more rapid progress to 1930.⁹³

1852 Ordinance obliged property owners in France to provide connections to the public sewer for rainwater and household waste water.

The Paris sewers and water system

In Paris, most change took place under Napoleon III and the Prefect of the Seine under him, Baron Georges Eugene Haussmann. Napoleon III's dramatic transformation of Paris involved the destruction of many of the slums near the centre of the city. This was in part a response to the unsanitary conditions of life there, an attempt to prevent further epidemics and to remove the unpleasant and embarrassing side of Parisian life from the grand, new, elegant boulevards. Unfortunately, this did not ensure that those moved to new areas of the city received water or sanitation facilities.⁹⁴ However, other changes had a more positive impact. It was under Haussmann that the Paris Water Supply was introduced. His engineer, Belgrand, introduced a double system of water supply; one supply for household use and another, of lower quality, for industrial use. Tapping the Dhuis in 1862 and the Vanne in 1874, alongside other new sources, doubled the daily water supply by 1870. By 1870, approximately half Parisian houses had water on the ground floor, which included about 34,000 people, compared to 6000 in 1864. He also designed the Parisian sewer system, which was planned in 1856, and the main sewers were

⁹² Goubert 1989 196

⁹³ Goubert 1989 196

⁹⁴ Couperie 1968

completed by 1868 (in record time). They led into the Seine far downstream, below Paris.⁹⁵ It was not, however, compulsory to use the sewerage system until 1894.⁹⁶

Hausmann, Poubelle and others attempting to implement reform in France came up against equally resentful landowners. An ordinance of 1852 Another ordinance, of 1894, required property owners to connect to the public sewer for sanitation purposes. Both demands caused great resentment amongst landlords, and the regulations were not enforced until 1897. Even then there was no effort to enforce it amongst all landlords at once.⁹⁷

From **1870, a Bureau of Public Health and Hygiene** was established in the Ministry of the Interior under Léon Bourgeois, and a Consultative Committee on Public Health.

1884 Public water supply became the legal responsibility of mayors.⁹⁸

However, by the 1890s, state commitment was still very limited. The **1893 National Standards in Public Health Act** was not implemented until 1904 largely owing to a reluctance to provide the necessary funds.⁹⁹

Ordinance, 1894, required property owners to connect to the public sewer for sanitation purposes.

Implementation: Private provision

Once this infrastructure was in place, private companies often operated as service providers, while municipalities retained ownership of the infrastructure.¹⁰⁰ This was standard practice in France, although management of the supply was more frequently contracted out in larger, more densely populated districts.¹⁰¹ The private sector dominated French water supply, and won big profits. It has been argued that it led to the ‘slow democratisation’ of water, as prices dropped. Indeed, between 1800 and 1850 the average price of water for the urban customer dropped considerably.¹⁰² ‘The first capitalist water company’, The Paris Water Company, had been established in 1778 by the Périer brothers. They sold water far more cheaply and widely than previous water carriers, using steam engines to power the supply.¹⁰³ However, private companies were shown to have invested less and charged significantly more per m³ than public water suppliers, as well as paying dividends to their share holders.¹⁰⁴

⁹⁵ Couperie 1968

⁹⁶ Goubert 1989 63

⁹⁷ Evenson 1979 208

⁹⁸ Goubert 1989 182

⁹⁹ <http://www.strath.ac.uk/Departments/History/barton/ds10.htm>

¹⁰⁰ Bakker 2003 20

¹⁰¹ Goubert 1989 182

¹⁰² Goubert 1989 23

¹⁰³ Goubert 1989 173

¹⁰⁴ Goubert 1989 187

Certain very significant improvements were seen in Paris, and were reflected in declining mortality rates and better conditions for many people. Typhoid, for example, killed 2121 in 1881, but only 773 in 1894.¹⁰⁵

Unfortunately, Paris's, still limited, achievements were exceptional in France. Other large towns and cities were far slower to invest in water and sanitation systems. Very few rural areas had modern water supply systems into the twentieth century and even fewer had drainage or sewerage facilities. The initial costs and subsequent maintenance expenses made such systems impossible for rural communities. However, the condition of wells and fountains generally improved, with a growing awareness of hygiene.¹⁰⁶ In Angers, the 1832 cholera epidemic was not severe enough to convince authorities to act, but they gradually increased supplies following the 1854 epidemic.¹⁰⁷

Resources

Edwin Chadwick, *Report on the Sanitary Condition of the Labouring Population of Great Britain*, intro. M.W. Flinn 1964 (original 1842)

Gilbert Child, *A Report on the water supply of Oxford, presented to the local Board, October 23 1866*, Oxford 1866

John Snow, *On Cholera*, 1936 (original 1854)

Karen Bakker, *An Uncooperative Commodity: Privatising Water in England and Wales*, Oxford 2003

Hugh Barty-King, *Water: The Book*, 1992

Pierre Couperie, *Paris Through the Ages*, London 1968

Norma Evenson, *Paris: A Century of Change, 1878-1978*, Yale Univ. Press 1979.

Isabelle Fauconnier *The Privatization of Residential Water Supply and Sanitation Services: Social Equity Issues in the California and International Contexts*
<http://www-dcrp.ced.berkeley.edu/bpj/pdf/13-Fauconnier.pdf>

Jean-Pierre Goubert, *The Conquest of Water*, Oxford 1989

Christopher Hamlin, *Public Health and Social Justice in the Age of Chadwick, Britain 1800-1854*, Cambridge 1998

John Hassan, *A History of Water in modern England and Wales*, Manchester 1998

John Hassan and Peter Taylor, *The Politics of water in Early and Mid Victorian Britain*, Manchester 1996

Charles D. Jacobson and Joel A. Tarr, *Ownership and financing of infrastructure: Historical perspectives*, Washington, D.C.: World Bank, Office of the Vice President, Development Economics, 1995.

Maria Kaika, *City of Flows: Modernity, Nature and the City*, NY/London 2000

David Sellers, *Story of Sewerage in Leeds*, Leeds City Council 1997

F.B. Smith, *The People's Health 1830-1910*, London 1979

WM Stern 'Water supply in Britain: The Development of a Public Service', Royal Sanitary Institute Journal, LXXIV (1954) 999 quoted in Hassan 1985

Jacques Valdour, *La Vie Ouvrière*, Paris: Rousseau 1921

<http://www.translucency.com/frede/parisproject/> Paris Sanitation before C20th.

¹⁰⁵ Evenson 1979 210

¹⁰⁶ Goubert 1989 208

¹⁰⁷ Goubert 1989 195, 199, 207

<http://www.strath.ac.uk/Departments/History/barton/ds10.htm>

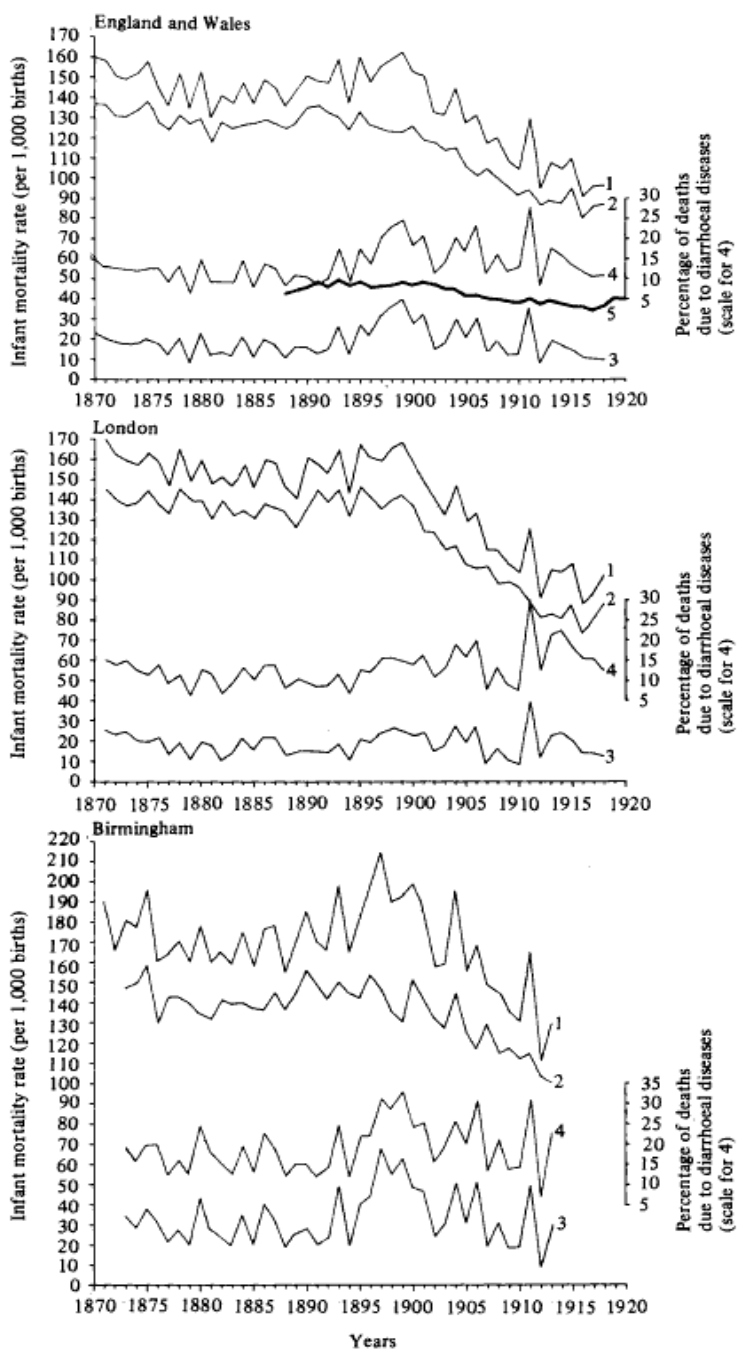


Figure 10. Infant mortality rate (q_0) (1); non-diarrhoeal infant mortality rate (2); diarrhoeal rate (3); percentage of infant deaths due to diarrhoea (4); neonatal infant mortality rate (5), for England and Wales, London and Birmingham, 1871–1918. (Note: (1), (2), (3) and (5) are $\times 1,000$. Sources: England and Wales and London – Registrar General's *Annual Reports*, see footnote 30; Birmingham – John Robertson, *Report of the Medical Officer of Health on Child Welfare in 1913* (Birmingham: Hudson and Son, 1914, p. 6).)