

The experience of the first sanitary revolution: Are there lessons for today's global sanitation crisis?

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The stench and filth of 19th-century London, especially from the discharge of raw sewage into the Thames, broke through inhibitions concerning bodily wastes to prompt a sanitary revolution. In today's world, around 1 billion people in even more rapidly expanding towns – and many more in rural areas – face a similar crisis. They are without toilets, let alone mass waste disposal systems, to deal with daily requirements for personal convenience, human dignity, and threats to public health. Yet this excreta-related crisis is rarely aired, and appropriate solutions are hopelessly under-funded. Somehow the Victorians conquered their squeamishness and committed major resources to the cleansing of urban space. This experience coloured the subsequent history of public health engineering, mostly for good but not invariably so. What was the impulse that allowed the problem to be addressed, and are there lessons to be learned that could inform the sanitary revolution so needed elsewhere today?

Keywords: sanitation, nineteenth century Britain

EXACTLY 150 YEARS AGO, an exceptionally hot summer in 1858 reduced the Thames flowing through London to a scandalous condition known as the 'Great Stink'. The smell of the river was so excruciating that parliament could barely sit, and sessions in the adjoining courts of law had frequently to be curtailed. London then suffered regularly from cholera, and it was still automatically assumed that airborne 'miasma' was responsible for its spread.

The pestilential nature of 'the Stink' had a powerfully concentrating effect on MPs' legislative faculties. The act they rushed through before proroguing for the season led to the transformation of sewerage in London by Sir Joseph Bazalgette, and eventually to a widespread public health engineering revolution in Britain and throughout the rapidly industrializing world. '*Laissez-faire*', declared an editorial in the London Illustrated News, 'is an excellent maxim where trade is concerned. But it is not to be tolerated when it comes to "the manufacture of poisons"'.

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doi: 10.3362/1756-3488.2008.006, ISSN: 0262-8104 (print) 1756-3488 (online)

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Would that such sentiments were more often expressed municipally, and internationally, today. A new sanitary revolution is desperately needed, on behalf of the 40 per cent of the world's population who are without a decent and hygienic means of dealing with the personal waste evacuation process which everyone on Earth has to manage on a daily basis. In the even more rapidly urbanizing developing world, still only a fraction of sewage is treated before ending up in heavily polluted, and stinking, rivers. Much excreta is washed into them – as in 1858 London – by storm water drains filled with 'excrementitious effluvia' that is either deposited in the open or dumped at night from cesspools and toilet pits. Great Stinks are by no means altogether banished to the past.

A story frequently re-told

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The story of the 19th-century sanitary revolution in Britain has been re-told so often that its main figures – men such as Bazalgette, Edwin Chadwick, the father of 'public health', and John Snow who insisted that a drinking water pump in London be closed to stem the spread of cholera – have developed mythological stature. Some of its most instructive features for the business of sanitary transformation in the modern era lie buried below layers of historical spin. One such feature is the length of time it took. The transformation of the urban living environment into something piped and sewered with plentiful safe water on tap, not only in the houses of the better-off with their flushing WCs, but in the cottages and tenements of ordinary working people, took over six decades to accomplish. This sanitization of urban settings was ultimately credited with eliminating squalor and epidemic disease, but the health impacts in terms of radically improved life expectancy and infant mortality rates did not show up until well past the turn of the 20th century (Smith, 1979). Sanitation's impact on health takes time – a lot of time. Ten or 15 years is nothing.

The long process of legal, municipal and sanitary reform in Victorian Britain was accompanied by heroic efforts by engineers and reformers on many fronts, and many U-turns in public policy. Many original diagnoses of urban public health problems were wrong, or where they were right, took time to gain traction. Social and class attitudes were also in the process of transformation as were all aspects of economic and political life. Industrialization represented an extraordinary social upheaval, of which the sanitary revolution was both a symptom and a result. The struggle to clean up the towns was long and hard, and the much-celebrated legacy of the sanitary component has shaped theory and practice surrounding public health

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ever since. However, during the subsequent export of its ideas and models, including to what were originally overseas colonies, and to other Asian, Antipodean and American outcrops of metropolitan influence, some of the most important lessons became obscured.

The role of both the private and the public sector is one of the most conspicuous. In the early part of the transformation, the private manufacturing sector was critical in producing the toilet, along with taps, pipes, pans, basins, cisterns, U-bends, valves, cocks, spigots, and all kinds of bathroom and sanitary ware. All this happened in response to demand for home improvement – and in fact it was the consumer take-up of flush toilets and their voluminous output that led to the Great Stink of 1858. But the mass disposal side was another matter.

To begin with, private companies were responsible for water supply and sewerage construction – no other providers were envisaged. A regulatory framework was passed into legislation in various Waterworks Acts, but it was distinctly 'arms-length' and largely a failure (Hassan, 1998). The leaders of the sanitary movement were convinced from the start that the extraordinary state of filth in the slums could not be addressed without decisive public action. Thanks to their tireless campaigning, a Public Health Act was passed in 1848, but compliance proved a nightmare. For many decades, the roles of local and central authorities became a battleground, opening up the idea of political intervention in intimate areas of people's lives and leading to municipal public expenditure on an unprecedented scale. It became clear that private companies were not willing to provide water mains and waste disposal to those outside the 'respectable' classes: the costs were too high and the demand – in the form of ability or willingness to pay – much too low. Encouraged by legislation and easy loans, municipal authorities took over the companies, extended and improved their services, running them in the interests of society and 'civic pride' rather than for private profit. Surely these lessons are valid for the contemporary world. In the slums of cities such as Dakar and Nairobi, Delhi and Manila, all of which are expanding at a much faster rate than 19th-century London, there is a similar need to consider social good, and as little 'ability to pay'. And even if the numbers of those without sanitation in rural areas are higher, it is in the less salubrious parts of towns that today's sanitary crisis is most in evidence.

Another outcome of the 19th-century sanitary revolution is that the retrospective benefits in terms of public health have been etched onto the universal mind as the primary motivation for sanitary improvements: indeed, the whole discipline of 'public health' was the invention of Chadwick and his allies. Yet 'public health' was a public good motivation for change, not a private consumer or

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market-based motivation. Private consumers, where they had the income, wanted to urinate and defecate in a respectable, clean and comfortable environment. At no time did they see a toilet as a health aid – no more than do their counterparts in the developing world today. Those who were poor, whatever their desires, did not have the means to pay for flushing closets, water rates, and night-men to clean out their cesspools. And their better-off neighbours were in no mind to vote for the money to provide the poor with these facilities. These attitudes – concerning both demand for decent facilities among all classes of society, and political unwillingness by the elite to pay up for a clean and wholesome urban environment for all – are mirrored in many developing country settings of today.

The public health motivation: Epidemic disease

The public health motivation only applied when it became clear to the better-off that they were threatened by diseases circulating in the poorer parts of town. In this, the miasma theory of disease and the panic induced by cholera – which arrived from Asia in the 1830s and quickly became the new epidemic killer disease of urbanizing Europe – were on the reformers' side. Edwin Chadwick resolutely believed that 'all smell is disease', and one of his close associates, Dr Niall Arnott, echoed him in describing the cause of many diseases as 'the poison of atmospheric impurity' (Eveleigh, 2002). Their enthusiasm for underground sewerage was therefore primarily related to the disease-spreading nature of the stink. Interestingly, modern research suggests that there is a strong co-relation between the instinctive human reaction of disgust and proximity to disease-carrying agents (Curtis, 2001). However, Chadwick and his contemporaries thoroughly misread the nature of the connection.

The association of cholera spread with foul water was first discovered in one of the most famous incidents of sanitary history, when Dr John Snow carried out an epidemiological survey into the extremely high incidence of cholera in a part of Soho, London, during the 1854 epidemic. Snow painstakingly enumerated every facet of the local houses, inns and shops, and the water-consumption patterns of their inhabitants – a scientific method which was itself relatively novel. He proved that the imbibing of water, or beverages made from water, from a particular public pump in Broad Street was the essential common denominator in the majority of cases. He noted that many people drew water from this pump because they preferred it to that from other pumps; this was the cause of cases outside its immediate vicinity. Having completed his inquiry, Snow went to see the Board of

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Guardians for the parish – the local council of its time – who ordered the handle of the pump removed (Cosgrove, 1909).

The right lesson obscured

Recounted with gusto by historians down the years, the closing of the Broad Street pump has become an iconic moment in the birth of public health. At the time, Snow was ignored. The miasma theory was so well entrenched and its supporters so powerful that only after another epidemic in 1866 was Snow's evidence of water-borne infection given belated recognition. It took until 1883 for Robert Koch, a German bacteriologist, to identify the cholera bacillus in India and show that it was conveyed in water polluted by the faeces of victims.

Today it is difficult to evoke a world in which scientific information on a matter of such importance took so long to become established and widely known. Except that it is still the case today in parts of Africa, and wherever illiteracy is common, that belief in the miraculous propagation of disease by witchcraft or curse remains current, even among some highly educated members of society. And preference – both with regard to drinking water source and long-established excretory habits – is also an important consideration in understanding behaviour, convictions and consumer tastes in many developing country settings.

In the subsequent retelling of the glorious Snow moment, a curious transposition has occurred. The lesson passed down to posterity is far more closely associated with the safety of drinking water as the key to disease control, than with the dangers of inadequate sanitation. And the pre-eminence of Snow in the story has ejected another important claimant from his share of diagnostic fame. The Reverend Mr Whitehead, curate of a nearby parish, and like Snow a member of the Cholera Inquiry Committee, also carried out a house-to-house investigation in the area. Both Snow's and Whitehead's reports showed an explosion of fatal attacks on just two particular days, with an immediate decline – which, interestingly, began some days before the pump was disconnected (Cosgrove, 1909).

Whitehead delved deeper than Snow into the mystery of how the well had become infected. In house no. 40, Whitehead discovered that there had been an earlier case of a cholera-like disease, and that 'dejecta' from this patient had been thrown into a cesspool very close to the well. A surveyor was called in and found the brickwork of the drain and cesspool highly defective, with a steady percolation of fluid matter from the privy into the well. Whitehead thus not only confirmed Snow's water-borne disease theory, but pinpointed the cause. If he had been the subsequently celebrated hero instead of

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Snow, perhaps diseases that have ever since been inaccurately characterized as 'water-related' might have been termed 'excreta-related', with the emphasis on the real culprit, thus avoiding many subsequent misperceptions and wrong policy choices. The term 'water-related' is easily confused with 'water-borne', with which it is often used interchangeably. As recently as 2002, the WHO's World Health Report placed the emphasis on household water safety as the key to reduction of faeces-related disease (Cairncross, 2003). In fact, public health experts today agree that lack of toilets and hygiene knowledge are much more complicit than safe water in the spread of diarrhoeal infection. Whitehead also concluded that the water had only been infected for a very few days, and instead of multiplying, the cholera germs had died out. He attributed this to the coldness of the water – cited as the reason consumers preferred that pump. Thus preference may not be so misleading as a disease protection quality as is often assumed.

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Four years later, when legislation was finally propelled onto the statute book in 1858, public alarm was widely expressed that the huge £3m cost of the works to be constructed would be spent in vain by an untried and unknown public body set up for the purpose. This will sound familiar to those who expect the worst of large engineering infrastructure projects in under-regulated developing country environments today. Many commentators objected that emptying the contents of millions of Londoners' bowels into the Thames, duly treated and sanitized, via a special pumping station downstream, would represent an extraordinary and expensive waste of manure. A contemporary versifier in *Punch* (the subject of the filthy Thames was a great goad to the contemporary muse) wrote as follows:

Sewage, O why with rain dilute?
Your rain with sewage, why pollute?
Each will the other spoil;
To mix them is the great mistake;
Your rainfall to the river take,
Your sewage to the soil.

There was much more in similar vein, roundly denouncing Bazalgette, his Board of Works, and their monstrous and extravagant tunnels.

The value of human 'manure'

This debate was to run and run. For many decades, there continued to be a spirited contest between the proponents of water-borne sewerage for the sanitation of towns, and those advocating what was known as 'dry conservancy'. The principal argument against the

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flushing of wastes was the heavy pollution of rivers – as in the case of the Thames. Gradually, from the 1850s on, systems of sewage treatment were developed, and in 1876 an act was passed prohibiting discharges of untreated pollutants into waterways. Even though its administration was weak, this laid the basis for river protection. The loss of soil nutrients was also a strong argument in favour of 'dry conservancy'. In this system, toilets would be flushed with sifted earth, solid excreta collected and applied to agricultural use, and rivers would thereby be saved from 'feculent corruption'. In 1861, a well-known German authority on fertilization, Justus von Liebig, published a book entitled *Agricultural Chemistry*, in which he proclaimed: 'The introduction of water closets into most parts of England results in the loss annually of the materials capable of producing food for three and a half million people'.

An equally ardent believer in 'dry conservancy' was the Revd Henry Moule, who took out his first patent on an earth closet in 1860. Within three years, two of his models were being manufactured and widely sold. The protracted stand-off between the flushing properties of 'wet', versus the manuring capacities of 'dry', is very similar to the stand-off today between advocates of ecological sanitation (separation of excreta at the point of deposit, composting of faecal matter, and deployment of nutrients in agriculture) and enthusiasts for the water-flush. When it comes to consumers, the olfactory and aesthetic appeal of the U-bend and water seal seem to be virtually universal – where they can be afforded. But in the late 19th century, as today, the champions of water-flushing were by no means always in the ascendant.

Advances in agricultural science had stimulated both the manufacture of super-phosphates – the first chemical fertilizer – in 1842 and the import of guano from Latin America from around 1841 (Goddard, 1988). These were expensive, so there should have been demand for alternative sources. Several reports of the Sanitary and River Pollution Commission in the 1860s and 70s advocated the adoption of sewage in agriculture. Excreta-irrigated farms were introduced where cows and sheep peacefully grazed – one at Nottingham was so much the rural idyll that it attracted foreign visitors (Hassan, 1998). In the latter part of the century, over 100 large towns and cities in the UK launched schemes for the collection and distribution of sewage as manure on the expectation of healthy profits. Specially designed pails were given out to householders for regular collection and replacement. As late as 1911, two-thirds of Manchester's inhabitants lived in houses which depended on pails, ash-boxes, or a privy midden. In Dublin in the 1880s, 110 night-men and 39 horse-carts were employed to remove the contents of ash-pits, and Glasgow had 240 'wheelers' on its books (Wohl, 1983). But there were many prob-

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lems with the re-cycling of excrement. Cartage was expensive, and storage posed problems of public nuisance. Another problem was that, to make the system hygienic, pails had to be sanitized with chemicals, and this reduced the value of the content as a fertilizer. Yet another was competition from other types of agricultural manure. In the end, it turned out that no large town was able to make money out of human muck.

The long experience in British towns with 'dry conservancy' has been forgotten, and the lack of profitability and other characteristics which made it inferior to water-borne sanitation, and finally eclipsed its use altogether, ought to be studied carefully by today's enthusiasts for ecological sanitation. The lessons of its abandonment do not mean that improved methods of dry sanitation and nutrient recycling are universally unworkable – the political economy of sanitation in the many different settings of the contemporary world has important differences from those in late 19th-century Europe – nonetheless, valuable lessons may be learned.

Water-borne sewerage triumphant

What cannot be disputed is that – with all the trials and tribulations of its slow adoption – the water-borne solution proved itself hygienically and aesthetically in the setting in which it was invented. Its success over time, and associated improvements in the quantity and pressure of water supplies and in sewage treatment systems, was remarkable. What was also remarkable was that the sanitary reformers managed to make sewers and stinks part of the discourse of the Victorian age, even in newspapers and magazines read by polite society. The opening of Bazalgette's southern intercepting sewer outfall into the Thames east of London on 4 April 1865 was attended by the Prince of Wales, Prince Edward of Saxe-Weimar, the Lord Mayor of London, the Archbishop of Canterbury, the Archbishop of York, and 500 guests who dined on salmon while the city's excreta gushed forth beneath them. In the 21st century, celebrities and society leaders are happy to attach their names to campaigns on water, but rare are those to have identified themselves unreservedly with the need for sanitary advance.

The sanitary reformers managed to make sewers part of the discourse of the Victorian age

How can the level of Victorian political will and public investment be regenerated on behalf of the 2.6 billion people sanitariously unserved in the developing world today? Since those days, with the exception of Mahatma Gandhi's protestation that 'sanitation is more important than independence', the efficient and hygienic disposal of human excreta has not again become a matter of major public campaigning or moral reform in the world at large. For far too long, the extraordi-

nary accomplishments of the 19th-century generation of sanitary heroes have succeeded in putting excreta, its hazards, and its removal from homes and streets out of sight and out of mind. Today, finally, burgeoning urban populations, high levels of water and soil pollution, squalor in slums and crowded settlements, municipal mismanagement and need for reform, and epidemics of diarrhoeal disease posing serious threat to human life are pushing these issues back up the agenda.

In January 2007, the Centre for Science and Environment in India published a book entitled *Sewage Canal: How to Treat the Yamuna*. The problem it described was very similar to the Great Stink of London in 1858. The Yamuna River flowing past Delhi is filthy, polluted and fouled by human excreta, and vast expenditures on sewage treatment have so far failed to clean it up. Stinks, therefore, are still part of the armoury for promoting sanitary reform. With the demise of the miasma theory, cholera carried on the breeze no longer instils the terror it once did; but the pollution and even the death of rivers remains an important impetus. Toilet missionaries with an entrepreneurial flair such as the Revd Henry Moule are needed as never before. 'A good sewer', declared John Ruskin, the Victorian artist and social critic, 'is far nobler and a far holier thing...than the most admired Madonna ever painted'. May his successors stand forth, and set the next sanitary revolution in motion.

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