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TYPHOID AND SEWERAGE IN MELBOURNE

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Introduction

Over the last 150 years there has been a dramatic reduction in sickness and death due to infectious disease in Australia (and similar societies). Notwithstanding significant developments in medical practice (smallpox vaccination, diphtheria antitoxin, antibiotics), the main factor leading to the control of infectious disease has been improved living conditions (sanitation, food, housing). This has never been seriously questioned.

Over the last 80 years there has been a dramatic increase in mortality from a new set of social environment/lifestyle diseases.

There may be important lessons, in terms of preventive practice, that may be drawn out of the historical processes which led to the control of infectious disease. Partly in response to this prospect there has arisen a new focus of academic study, seeking to explain improvements in health. This study has tended to formulate the research question in these terms; have improvements in health been due to improved medical practice or due to changes in the way we live, the society we live in?

Thus, McKeown¹ has examined the reason for the decline in tuberculosis mortality in England since around 1830. He traces the falling death rates and considers various factors which might have been instrumental. He concludes that the main cause for improved mortality during the nineteenth and early twentieth century was improved food supply to the towns and the resultant improvements in nutrition.

This conclusion leads to another question. Assuming that improved nutrition was responsible, was it the result of teaching and lobbying

from the public health experts or the result of evolving technology, and changing economic and political relations? Were the health improvements deliberate or incidental?

These questions are relevant to the prevention of contemporary health problems (heart disease, lung cancer, road trauma, etc) because they have important implications for the style of work adopted by all those consciously seeking to improve the health of the community (the clinicians, the health educators, the public health advisers and diverse politicians and activists).

It is unfortunate that some of the research into causes of improvements in health appears to be couched in either/or terms: medical practice or environmental change. This may be a response to widespread assumptions which have overestimated the role of medical practice. As the sanitary revolution recedes into the past, the view that medicine was 'responsible' for the control of infectious disease has gained some credence. Indeed, Pensabene² argues that this belief has been actively used in order to promote the medical image and to advance policies favourable to the profession.

Nevertheless, it is clear that the either/or formulation is limited and that a more useful explanation requires an understanding of the interaction between the various changes (clinical and environmental) which accompanied the control of infectious disease.

The relation between typhoid and sewerage in nineteenth century Melbourne offers a case study in which some of these different interactions may be explored.

Nineteenth Century Melbourne

Port Phillip Bay was discovered in 1802 but not settled until 1835. The first wave of settlers were sheep farmers looking beyond Tasmania for grazing land.³

From 1835, Melbourne grew rapidly, to 23,000 in 1851.⁴ The economy of the town during this period was based mainly on servicing the pastoral industry (supplies, wool exports, etc).³

In 1851 gold was discovered, and over the next 10 years the population of Melbourne grew five-fold (to 126,000 in 1861).⁴ During this time Melbourne had a large transient population and its industry diversified considerably to meet the needs of the gold fields as well as the pastoralists.

As gold became harder to get, more and more people looked to farming for a livelihood. There developed a powerful movement to 'unlock the land' from the control of the squatters. This was finally achieved in 1865⁵ and a large number of people sought to establish themselves as free selectors.

Industry in Melbourne grew steadily, and the urban bourgeoisie came to challenge the political hegemony of the landed gentry, in particular, over protection versus free trade. The protectionist cause was in the ascendancy and from 1871 stiff tariff barriers were set up to protect Melbourne's industry (eg, clothing, boots, coachbuilding, implement making, building).³

The 1880s were the boom years for 'Marvellous Melbourne'. The boom was based partly on industrial development in a protected market and partly on rapid capital inflow associated with rampant land speculation. During the 1880s the population of Melbourne almost doubled (to 490,000 in 1891).⁴ The speculative money flowed particularly to land owners and to entrepreneurs in commerce and industry. The prosperity was not shared evenly. Many working class people were living in crowded, jerry-built houses in dirty and often pungent inner suburbs and working long hours for small money.^{6,7} During this time the realities of class became recognised by both owners and workers, and unions developed rapidly.⁸

The bust came in 1890 with financial failures, depression, strikes and great suffering. From then to the turn of the century was a period of reconstruction.

Typhoid In Melbourne

Children born during the late 1880's in Melbourne stood a 1:5 risk of dying before their first birthday.⁹ For the population generally, there were around two deaths per year for every 100 persons.⁹ Diphtheria, scarlet fever, tuberculosis, infantile gastroenteritis, were just a few of the major killers.

Typhoid fever was present continuously from the time of settlement with superimposed epidemics.¹⁰ It affected mainly young adults. Infection was due to distant contamination of the water supply or milk supply or more immediate faecal contamination of fingers, food and other objects, as when nursing a patient at home. The clinical symptoms would start about 10-14 days after exposure with fever, fatigue, weakness, and confusion. The fever would often last for three or four weeks. If the patient died, it was usually because of perforation of the bowel, or bleeding from the bowel. About 1 in 10 patients died, although in some epidemics it was closer to 1 in 4.¹¹

Our present knowledge about the mortality from typhoid during the early period of settlement is uncertain because of diagnostic confusion between typhoid and infantile gastroenteritis and other conditions. Cumpston and McCallum¹⁰ have carefully considered contemporary descriptions of various clinical entities and have prepared estimates for typhoid death rates for persons aged more than five years. (Younger children are excluded to avoid confusion with infantile gastroenteritis).

Figure 1 illustrates the horrific death rate from typhoid, particularly in the 1880s. A Royal Commission set up in 1888 compared the rate in 1886 for the city of Melbourne (6.9/10,000) and the rest of the metropolis (9.1/10,000) with the rates then reported from London (1.7/10,000) and 27 provincial English towns (2.8/10,000). The death rate increased still further to a peak of 12.5/10,000 in 1889. The Royal Commission also pointed out the differences between suburbs from 2/10,000 for Kew, to 11.5/10,000 for Brunswick, 11.0/10,000 for Footscray.¹²

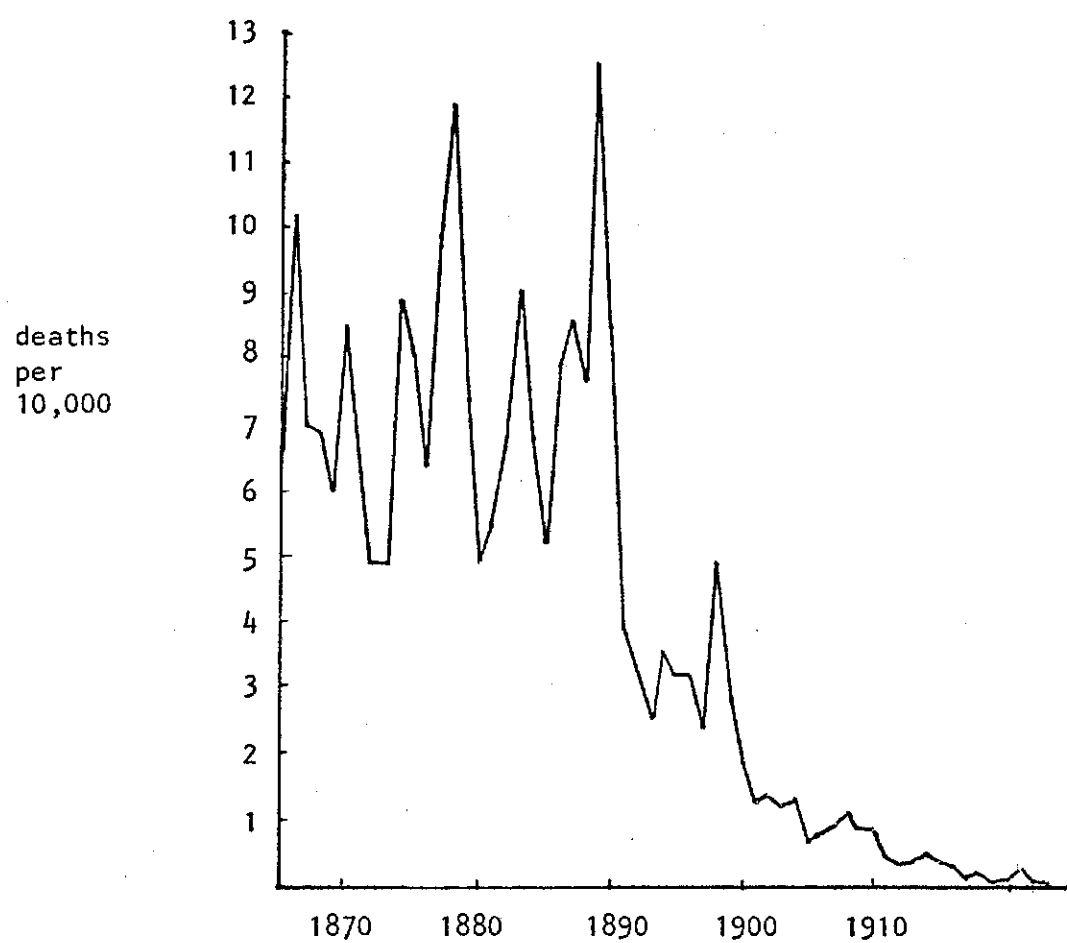


Figure 1: Death rates from typhoid, metropolitan Melbourne,
under fives excluded.¹⁰

These figures do not give a clear picture of the individual suffering of patients and families. During the epidemics of the late 1880s the hospitals could not cope and it was necessary to set up a typhoid camp in the grounds of the Alfred Hospital.¹³

The most important outcome of the 1889 Royal Commission was the final push it gave towards implementing a metropolitan sewerage scheme, forty years after it had first been called for. Work on Melbourne's underground sewerage scheme was commenced in 1892 and it was declared open in 1898.³ Over the next several years, most houses and premises were connected. It is paradoxical that the dramatic decline in typhoid death rates in Melbourne coincided with the decision to sewer the metropolis rather than its implementation. (See Figure 1). Cumpston and McCallum have argued¹⁰ that this immediate decline was due to 1889 legislation, which gave increased power to the reformed Board of Public Health, particularly its medical inspector, Dr. D.A. Gresswell.

Why was typhoid a major killer to 1890? Why did the death rate fall from then on?

In seeking to understand why the typhoid death rate rose to such high levels and then fell, it is necessary to consider the sanitary arrangements in nineteenth century Melbourne. We should discuss water supply, drainage, the evolving privy, sewerage, and finally, the developments in public health administration.

Melbourne's Water Supply

It is conventional wisdom that a good water supply is an essential prerequisite in any program to combat typhoid (or other diseases spread by faecal-oral contacts). Hand washing and other aspects of domestic hygiene all require adequate water. Melbourne had an excellent water supply from 1858 and yet, because the excellence of the water supply was not matched by that of the drainage and sewerage system, typhoid remained out of control.

The earliest settlers in 1835 drew their own water from the Yarra. By 1839 a pump was installed at the riverside and water was sold to water carriers by the barrellful.¹⁴ Ten years later an overhead tank was set up at the corner of Elizabeth and Flinders Streets and water was pumped from the Yarra and sold to the water carriers from the tank.¹⁴

Because of the increasing pollution of the Yarra upstream, these arrangements were obviously unsatisfactory. As early as 1840 there was a protest meeting called to complain about the frequency of 'colonial fever' (probably typhoid).¹⁴ In 1848, a committee of the Melbourne Corporation described the filthy and unsanitary conditions of the town and called for a proper system of sewerage and a fresh water supply as a first priority.³ In 1852, a Select Committee of the Victorian Legislative Council inquired into Melbourne's sanitary arrangements and called for the establishment of water supply and sewerage.¹⁵ Immediate action on water supply followed (although sewerage was to wait for another 40 years).

In 1853, a Water Supply and Sewerage Commission was appointed and construction of the Yan Yean reservoir and supply lines were commenced. The Yan Yean based water supply was formally opened in Melbourne in 1858.³ The Central Board of Health at the time was optimistic that the completion of the Yan Yean system would provide an 'ample supply of water for domestic and sanitary purposes', both for Melbourne and the various suburban municipalities.¹⁶

It may be that the distribution network did not extend quite as fast as was envisaged. Barrett records that as late as 1870 there were many side streets in Collingwood which still did not have piped water.¹⁷

In view of the dramatic growth of Melbourne's population during the gold years, it is not surprising that the capacity of the Yan Yean system was soon reached. During the summer of 1871 there were periods of several days when the water supply failed. An official inquiry¹⁸ concluded that the supply was in fact adequate, but it was being wasted. There were more shortages in succeeding years, such as

1875, when during the 'hottest January on record whole districts were left for some days without a drop of water'.⁷ It was not until 1891 that the Maroondah Reservoir came on line and Melbourne's water supply was again guaranteed.⁷

Barrett comments that Melbourne was well ahead of London in establishing a pure, publicly owned water supply. However, in the absence of adequate drainage and sewerage, it may have contributed more to the spread of disease than to cleanliness. Many industries which used water had no alternative but to direct the wastes into the neighborhood drains. The breweries on the Collingwood hill would use a considerable amount of water to wash their barrels. The water would drain down the hill, where it would stagnate, a major health hazard for the people of the flat.¹⁷

The availability of water encouraged hotels, hospitals, city buildings, to install primitive water closets before there was a sewerage system for them to empty into. Officially, the flushings would be collected in a night-soil tank which was supposed to be emptied regularly. Not infrequently it would overflow, or worse still, be pumped into the street drains during the night.

With unlined cesspits and overflowing night-soil tanks, the ground of Melbourne was, in places, saturated with faecal material. Dr. Springthorpe, in 1894,¹¹ commented that leaks in the water supply pipes, where they passed through such sodden ground, provided ample opportunity to contaminate the water supply.

The most dramatic sanitary defect in the water supply was the design of the Bateman fire plugs.¹⁰ These outlets for connection to hoses in case of fire were vertical side arms off the water main. The side arm ended in a box recessed into the pavement. There was a ball valve in the fire plug which prevented the escape of water, except when the hose was attached, in which case it would push the ball down and release the flow. Two conditions rendered these seemingly innocuous plugs into potential sources of widespread infection. Where fire plugs were located in sodden, stagnant ground, the boxes in

which they were recessed would fill up with foul, contaminated liquid. When the water pressure fell, because of maintenance work or high demand, the ball would fall back and the contaminated fluid would drain into the water supply, to be widely distributed as soon as pressure was restored. The role of these plugs in injecting typhoid into the water supply was meticulously documented by Gresswell in 1892, although he had campaigned against the plugs for several years before that.

Drainage

In early Melbourne, drainage from homes, hotels and shops either ran downhill or accumulated. A report to the Melbourne Corporation in 1848 mentions the filthy conditions of narrow streets, courts, alleys, and the lack of sufficient drainage. "The large swamp on the eastern side of the city, known as Lake Lonsdale, is moreover admitted to be most injurious to the health of citizens from the noxious vapours it emits in warm weather".³

An 1852 survey carried out on behalf of the Select Committee of the Legislative Council found that "many of the foundations of the buildings are greatly injured owing to the saturation of the subsoil by liquid excrementous matter. In the block bounded by Great and Little Bourke Street, Elizabeth Street and Swanston Street, there is a space of upwards of one hundred square yards hitherto occupied by a green semiliquid mass, partly formed by the outpourings of surrounding privies.....".¹⁹

Two years later, the newly appointed Chief Health Officer, Dr. William McCrae, commented on the 'undrained, crowded, badly ventilated and filthy state in which the City of Melbourne is at present...'.¹⁶

In 1854, the Legislative Council passed a law enabling the City of Melbourne to borrow money to commence street improvements.³ A drainage system was built, based on large open channels by the side of

the roadway, so wide and deep as to require small foot bridges across them. These channels formed the basis for Melbourne's drainage system for almost thirty years.

The channels carried garbage, sewage, domestic and commercial drainage as well as storm water. They stank, as well as being inadequate to cope with thunderstorms. Within a few years (1859) the Central Board of Health was calling for their replacement by a system of underground drains.¹⁶ Melbourne's drains finally went underground in 1883. These drains were designed for storm water only and sewage was rigidly excluded.⁷

The building of drains was a municipal responsibility and the enthusiasm of councils depended on the lie of the land and the income from rates.

In lowlying Collingwood, liquid refuse stagnated and saturated the subsoil. An open central drain was cut in 1850, draining to the Yarra. This was lined with bluestone in 1861. However, a single channel could not drain more than a narrow strip and in 1867 an underground drainage system was commenced. The Collingwood drains (with an admixture of sewerage and large volumes of industrial pollution) found their way to the Yarra, to the annoyance of the City of Melbourne downstream.¹⁷

The Evolving Privy

The standard privy in the early days of settlement was the cesspit, basically a hole in the ground with closet and seat above. Either the soil absorbed the fluid or, if the cesspit filled up, the owner could dig a new hole (and move the closet) or empty the cesspool (to land or water), or allow it to overflow.

The unlined cesspit was obviously unsatisfactory in city buildings, hotels, commercial premises and it was soon replaced by a lined cess-

pit or tank which could be emptied regularly. Supposedly, the tank was emptied at night (hence 'night-soil') by contractors. In fact, it was often pumped, illegally, into the open street channels.

The introduction of the water closet in some city buildings allowed for flushing of faeces to the night-soil tank, so the privy did not have to be located directly over the tank. However, the introduction of the water closet greatly increased the volume and hence the temptation to pump it into the streets at night.

Except for the more wealthy riverside or hilltop homes, the water closet was not widely used domestically, because of the problem of drainage. For most homes the cesspit was used. Despite recurrent calls from the Central Board of Health for these pits to be lined¹⁶ it was stated in 1882²⁰ that "the majority ... are mere holes in the ground".

By 1865, with a population of around 160,000, the cesspit method of disposal had clearly failed to cope. "Cesspits overflow in all parts of the city. The contents percolate through the soil in those places where the formation is favourable to this process. In other parts it remains on the surface until evaporation takes place. Many houses have water closets with outlets opening into the streets, through which the Yan Yean is permitted to flow carrying with it the poisonous materials." (Thomas, cited by Russell,²¹)

The Government responded with a compromise measure in 1867 which banned unlined cesspits. However, it was left to the various municipal councils to enforce this legislation. The only alternative to the cesspit (lined or unlined) was the portable pan system.

The pan system involved a contractor coming round (at night) with a horsedrawn night-soil tank and tipping the contents of the pan into the tank, then replacing the pan. The householder generally had to contract directly for the service, so as not to increase the burden on ratepayers. The contractors supposedly carted the night-soil to a nearby farm or market garden or other depot. However, it was common

practice to lighten the load by the roadside or crossing a bridge over the Yarra.

A variant on the pan system which was in vogue in the early '70s was the earth closet, which provided for a sprinkling of earth in the pan to absorb the moisture and diminish the smell. The rationale for the earth closet was the miasma theory of disease, which held that contamination occurred via the air, the noxious vapours. Accordingly, deodorants in the privy were an essential sanitary protection. The earth closet added greatly to the load on the night-soil cart (and hence to the temptation to tip it by the roadside).

During the 1870s and '80s most suburban councils were closing unlined cesspits and promoting the pan system.

An advance on the single pan system was the double pan system, introduced first in St. Kilda. Under this system (which has lasted well into this century), the contractor replaces the used pan with a steam cleaned, disinfected pan. The used pans are taken to the depot where they are emptied and cleaned. According to the figures presented to the 1888 Royal Commission,¹² St. Kilda had one of the lowest typhoid mortality of all municipalities (4.2/10,000), no doubt because of the superior pan system. Most municipalities moved to the double pan system from 1888, although the single pan system was still in use in Collingwood in 1903 when the sewerage system was finally connected.¹⁷

As late as 1890 the pan system was common, but not the only method. Dr. Gresswell noted in 1890 that there were still many cesspools which sometimes overflowed into poorly drained backyards.²²

With the connection of the new sewerage system from 1897 the modern water closet became the standard privy.

The Sewerage Scandal

The scandal about Melbourne's sewerage was that construction was not commenced until 1892, forty years after the first official call for such a system.

- 1848 Committee of Melbourne Corporation describes insanitary conditions, calls for sewerage and water supply.³
- 1852 Select Committee of Legislative Council calls for sewerage and water supply.¹⁹
- 1859 Central Board of Health points to filth and insufficient drainage as a cause of epidemic disease, calls for sewerage system.¹⁶
- 1862 Central Board of Health repeats call for sewerage.¹⁶
- 1866 City of Melbourne invites State Government and other metropolitan municipalities to combine to build a sewerage network. Opposed by municipalities because of cost.¹⁷
- 1874 Conference of Councils to discuss proposed Board of Works. Rejected again because of impact on rates.¹⁷
- 1883 Proposal again raised, again rejected.¹⁷
- 1888 Royal Commission into Sanitary Condition of Melbourne appointed. Professor H.B. Allen, Chairman.¹²
- 1889 First Progress Report recommends sewerage.¹²
- 1890 Board of Works created.¹⁷
- 1892 Sewerage construction commenced.³
- 1897 First house connected.

The Royal Commission of 1888 came at a time of record typhoid deaths, the contagionist theory of infectious disease was finally prevailing, and a consensus was at last developing at state and local government level. Nevertheless, the Royal Commission did more than formalise changes that were inevitable. In its First Progress Report in 1889, the Commission documented clearly the link between typhoid and the prevailing insanitary conditions. The Commission was able to point to Adelaide, where typhoid mortality had fallen from 2.76/10,000 to 1.91/10,000 after sewerage was completed in 1885.¹²

Hospitals

The unfortunate manner in which hospitals collected and disposed of their sewerage undoubtedly contributed to the spread of typhoid, and other infectious diseases.

At the Melbourne Hospital, before sewerage was connected, the privy was a water closet located in the wards, connected by a down pipe to a cesspit, later a night-soil tank. The stench in the ward was notorious because, with no water trap, the ward was in direct communication with the atmosphere above the night-soil tank.^{7,23} The disposal of the night-soil created problems for the hospital administration. As late as 1892 it was being carted to a market garden in Oakleigh.⁷

Earlier, the night-soil tank often overflowed into the city drains or was actually pumped out at night.⁷ The Age reported in 1866 (2 Feb) that the hospital was using a high pressure jet of fresh water to break up the solid sewage in the night soil tank. The diluted liquid flowed (through a grating) through a waste pipe into the street channel. During 1868/9 the City of Melbourne launched several prosecutions against the hospital for drainage infringements.¹³

Similar arrangements operated at the Homeopathic Hospital in St. Kilda Road (now Prince Henry's). The water closets in the wards were connected to the night-soil tank by a down pipe. Initially there were taps provided in the wards to flush the pan after use. However, this led to overflowing of the tank, and so the taps were removed from the wards and flushing controlled from outside. Since the down pipes were not all vertical, the infrequent flushing led to blockages occasionally.¹¹

The opportunities for cross infection in the wards and for contamination of the city's water supply (eg, through Bateman fire plugs¹⁰) are obvious. As late as 1892 the Alfred Hospital night-soil was dumped at a dairy farm at Balwyn.⁷ The opportunities for contamination of the milk supply are obvious.

Public Health Administration

To understand how public health administration reflected the changing balance of political power it is necessary to review briefly the development of representative government at the state and municipal level.

From 1842 Port Phillip was a province of the Colony of New South Wales and entitled to six members in the 36-seat Legislative Council of New South Wales. One-third of the members of this council were nominated by the Governor. Only very wealthy people were entitled to stand as candidates or vote in the elections for the remaining 24 seats.²⁴

From 1851 Victoria was a separate colony with its own Legislative Council of 30 members; 10 nominated, 20 elected. Again there was a high property qualification for members and electors.²⁴

This ~~first~~ Legislative Council drafted a constitution for Victoria, and the new constitution (as amended in London) came into effect in 1855. This provided for an upper house (the 30-member Legislative Council) and a lower house (the 60-member Legislative Assembly). Suffrage for both houses was restricted to a few select occupations, including military officers, medical practitioners, clergymen, and lawyers. In addition, there was a property qualification. For the Legislative Council, electors had to own freehold title worth £1,000 or more or have a comparable income; members had to own more than £5,000 in freehold title or equivalent in income. For the Assembly, electors had to own freehold worth more than £50 (or equivalent income) and members have assets worth more than £2,000 (or equivalent income).²⁴

These provisions, which amounted to government by the rich were challenged by the gold rush, which brought to Victoria many radicals from Europe. Manhood suffrage was a major demand of the diggers³ and was introduced for the Assembly in 1857. However, the property qualification for the Legislative Council was not removed until 1950.²⁴

Although the property qualification for the Assembly was abolished from 1857, payment for members was not introduced until 1886,²⁴ effectively debarring significant working class representation up to this time.

The Corporation of Melbourne was established in 1842. There was a property qualification for councillors (assets of more than £500 or equivalent income) and, of course, voting was restricted to rate-payers, with multiple votes to wealthy ratepayers.⁷

In a rapidly growing new town there were many urgently needed public works, street improvements, gas lighting, drainage, as well as sewerage. In 1842 the Corporation requested a loan to finance water-works and sewerage, but it was refused in Sydney.¹⁴ With few staff and inadequate records, rate collection was not easy, and the Corporation was in recurring financial difficulties.

By 1854 the Corporation was under attack from all sides. The Argus (2/3/1854), perhaps reflecting popular (non ratepaying) opinion, was critical of the emphasis on street improvement instead of sewerage, and abused the Corporation for not increasing the rate in order to pay for urgent public works.

The landowners of the municipality were less keen on paying for metropolitan sewerage through their rates. In 1854 the Legislative Council passed the Municipal Act.³ This greatly facilitated the setting up of new municipalities. On a petition of at least 150 householders, from an area of more than 300 households, the Governor in Council was authorised to establish a new municipality. Established suburbs rapidly set up their own councils in order to divert rate income from the streets of Melbourne to the roads, bridges and town halls of the suburbs.

The suburban ratepayers had no enthusiasm for metropolitan sewerage; the Melbourne Corporation no longer had the authority nor income to do it alone. Despite repeated calls from the Corporation of Melbourne (1866, 1874, 1883 - see above), the suburban councils refused (until

1890) to cooperate in the building of a metropolitan sewerage system.

In 1854 the Central Board of Health was established, a three man body appointed by the Governor and answerable to the State Government. The Central Board of Health had limited power vis a vis the municipalities (acting as Local Boards of Health from 1865). The intransigence of suburban councils was a constant irritation to the Central Board of Health.¹⁶ In 1872 it commented that "councillors oppose sanitary measures for shortsighted considerations of self interest". The Board repeatedly called for the strengthening of the Health Act so as to give it more authority over local councils. Barrett recounts that although the Public Health Act of 1867 banned the unlined cesspit it was not until 1875 that Collingwood council chose to implement that ban.¹⁷ The Royal Commission of 1888 also commented that many municipalities were most uninterested and uncooperative in regard to its enquiries.¹²

In 1889 the Central Board of Health was replaced by a more powerful Board of Public Health with two government appointees and seven municipal representatives. With more authority and staff the Board was able to effect important improvements in sanitary arrangements.¹⁶

The new medical inspector to the Board, Dr. D.A. Gresswell, had clear ideas about the contagious nature of typhoid and the basic public health measures needed to curb its depredations.¹⁰

Amongst the (now familiar) sanitary rules implemented by Gresswell²² were covered garbage bins, regular removal of garbage, regular street cleaning, impervious channels for street drainage, double pan night-soil systems with steam cleaning and disinfecting, isolation of contagious patients with appropriate nursing precautions, and inspection of dairies. (In 1890 Gresswell visited 43 city milk depots and declared them all to be unclean.¹³) As medical inspector to the Board, Gresswell visited all the metropolitan councils, advising about sanitation, teaching about the importance of proper night-soil disposal.²⁵

In their careful analysis of the cause of the decline in the typhoid death rate from 1890 to 1895, Cumpston and McCallum¹⁰ attribute a major influence to the energy of Dr. Gresswell during this period.

Clearly the connection of the new sewerage system from 1897 onward was responsible for the continued improvement from then on.

Why did it take 40 years for Melbourne to control its typhoid problem?

The calls for sewerage date back to 1840. Many of the basic public health measures implemented by Gresswell from 1889 had been advocated by the public health authorities for many years.

To explain the 40 year delay, it is helpful to consider medical knowledge, political factors and advances in clinical practice.

Medical Knowledge

Nineteenth century medicine had two major theories to explain epidemic disease.

One group believed that the causative factors of disease arose spontaneously in the putrefaction of animal and vegetable products ('spontaneous generation') and that it was transmitted through filth and noxious vapours known as 'miasma'. The theory provided a rationale for cleanliness, drainage and ventilation as preventive measures. It did not make it easy to conceive clean water or milk as communicating disease. The term malaria (bad air) commemorates the miasma theory.

Opposed to the 'miasmatisists' were the 'contagionists' who based their view of epidemic disease on the germ theory being built by Pasteur and Koch, among others.

William Budd from Bristol published a series of papers in the Lancet (1856, 1859, 1860) demonstrating on epidemiological grounds that

typhoid was caused by drinking water contaminated by an 'excreted poison'. (Budd, cited by Smith²⁶)

The link between drainage and sewerage works and typhoid deaths had been recognised since 1832.²⁶ Virchow (cited by Jamieson²⁷) demonstrated a fall in the typhoid death rate in Hamburg from 4.85% of all deaths in 1844 (before sewerage) to 2.9% of all deaths in 1861 (after sewerage).

A theoretical basis for these observations was provided in 1862 when Pasteur demonstrated the role of yeast in the fermenting of beer (cited by Pensabene²). Over the period 1876-86, Koch isolated and demonstrated the pathogenicity of a variety of specific bacteria (cited by Pensabene²), and in 1880 Eberth, working in Zurich, identified the typhoid bacillus (cited by Mitchell¹³).

It is clear that Australian doctors were able to read overseas journals and travel occasionally to Europe. An 1867 reference to Budd's work in the Australian Medical Journal¹⁰ indicates that his views were at least being discussed. In 1876 the Australian Health Society published "Dr. Budd's rules for preventing the spread of typhoid fever".²⁸ These rules included hand washing and care with water supply. The society maintained an even handed approach by also publishing at the same time the views of Dr. Murchison, a leading exponent of the miasma theory. Notwithstanding his belief in spontaneous generation,¹⁰ Dr. Murchison's advice was sound: drinking water to be boiled and faecal matter to be kept well clear of the water supply.

There were widely read doctors in the colony from an early period. One such doctor was James Jamieson (1840-1916). From the time he settled in Victoria (initially Warrnambool in 1867), James Jamieson was receiving a range of European journals. In 1869 he wrote to the Medical Society of Victoria offering to provide translations and for many years provided abstracts for the Australian Medical Journal²⁹ Jamieson was undoubtedly familiar with the work of Koch, Virchow and Eberth within a short time of their publishing.

Australian doctors were also able to draw their own conclusions from the local situation.

Dr. Hunt commented in 1869 on the experience of the gold fields (cited by Cumpston and McCallum¹⁰), which pointed strongly to the view that faecal contamination of the water supply led to colonial fever.

Dr. Thompson, commissioned in 1874 by the Victorian Central Board of Health to report on typhoid fever, analysed carefully several case reports and concluded strongly in favour of the contagionist view. The Board was as yet unwilling to grasp the contagionist view and discounted Dr. Thompson's report.¹⁰

Dr. Harry Allen was also asked by the Central Board of Health (in 1877) to report on the cause of typhoid. Amongst other investigations, he studied an 1879 outbreak of typhoid in Jolimont. In a meticulous epidemiological study he documented the role of contaminated milk in spreading the disease. Again the Board was not disposed to accept his conclusions and the details of this study were not publicly presented until 10 years later.¹⁰

In 1883 there was a typhoid outbreak in Clunes which was carefully studied and reported by Dr. Colquhoun and later by Dr. Barrett. The link between faecal contamination of the water supply and the spread of typhoid was clearly demonstrated.¹⁰

Commentaries published by the Australian Health Society (AHS) in Melbourne reflect both the contagionist view and the miasma theory. In 1889 the AHS published a masterly review of advances in bacteriology by Pearson.³⁰ In 1886 and 1890, papers by Jamieson were published in which he demonstrates his familiarity with the overseas literature in relation to typhoid.^{27,31} Dr. Jamieson concluded that underground sewerage would reduce the death rate from typhoid by half. Dr. Jamieson was at this time a lecturer at Melbourne University and Medical Officer for Health with the City of Melbourne.

The previous M.O.H. for the city of Melbourne, Dr. T.M. Girdlestone,

was of the opposite view. In a widely distributed lecture ("Under the Floor", 1876, reprinted 1887),³² Dr. Girdlestone pointed to the dangers of sewer gas, alleging that the death from typhoid of Prince Albert at Windsor in 1861 was due to a sudden blast of air from the sewers. Dr. Girdlestone acknowledged the need for underground drains for storm water and waste water from sinks but argued that "sewers, as in London, are not presently required here". Dr. Girdlestone's views are particularly relevant because he was Medical Officer of Health to the City of Melbourne from 1868 to 1885 and was closely associated with the prominent merchant and politician, James Service, around 1865-76. They were both involved in the establishment of the Alfred Hospital and were foundation office bearers of the Australian Health Society in 1875.³³ Service went on to become Premier in 1880 and 1883-6.²⁴

The final ascendancy of the modern view of typhoid was perhaps marked by the 1889 Inter Colonial Medical Congress (General Secretary, Professor H.B. Allen) which resolved that typhoid is due above all to contaminated water supply, defective drainage, and improper disposal of night-soil.¹⁰

Almost the last bastion of spontaneous generation and the miasma theory of transmission was the Central Board of Health. In its 1861 report, the Board describes the overflowing cesspools "polluting the air with the deadly gases they evolve".¹⁰ In 1864 the Board refers to the "clearly defined connection of diarrhoeal disease with the foetid gases emanating from receptacles of filth".¹⁰

In 1874 Dr. W. Thompson was commissioned by the Board to report upon typhoid fever. Dr. Thompson surveyed current medical opinion and found it to be generally against the contagionist view. Nevertheless, on the basis of his reading and local research, he concluded that typhoid was spread by personal contact due to faecal contamination. (In his initial report he rejected the contaminated water supply theory as firmly as he rejected the view that the smell was of itself poisonous). Thompson was quite critical of the Board's adherence to the miasma theory and, although its official response to his report

was cautious, the Chairman, Dr. McCrae, later took a less formal opportunity to deride Thompson. The Australian Medical Journal was less careful, referring to Dr. Thompson's work as 'worthless'.¹⁰

The Board was stubborn. The Age of 21/7/1875 commented that the Central Board of Health was divided and confused as to contagion versus miasma. It was still confused in 1885 when it stated that "Typhoid is the result of the absorption into the blood of a specific poison generated by vegetable decomposition".¹⁰

Finally, in 1887 the Board recanted and issued a special report formally marking its conversion to contagionism and acknowledging the importance of faecal contamination of the water supply in the transmission of typhoid.¹⁰ This recognition greatly enhanced the case for sewerage. It was too late, however, for the Central Board of Health, which was replaced by the new Board of Public Health in 1890.

Comment is owed to the Australian Health Society, formed in Melbourne in 1875 (by several leading doctors and other influential persons) with the objects of educating public opinion regarding sanitary matters, encouraging hygienic behaviour, and seeking to remove noxious influences, including facilitating legislation in that direction. From 1875 onward the Society published, arranged lectures, encouraged health education in schools, and (presumably) lobbied the legislature.³⁴

In its publications up 'til 1890 the Society was even handed as between the miasma theory and the theory of contagion. Its main efforts were directed to public education, as for example, in the "Meetings for Wives and Daughters" (of the poor).³⁵ The emphasis was primarily on personal and domestic hygiene.

The confusion of the time is reflected in the views and activities of the founding vice president, Dr. T.M. Girdlestone. He was a vigorous proponent of Listerian techniques in surgery,^{13,23} but in the article cited above, argued against the need for sewerage on basically miasmatist grounds. In 1879 he was succeeded as vice president by Dr. Jamieson, an erudite contagionist.³³

It is clear that the theory of spontaneous generation of disease from filth, and its transmission as stench, appeared reasonable to ordinary people. It is also clear that the currency this theory enjoyed reduced the pressure for sewerage (with hints about the dangers of sewer gas), provided reassurance about the safety of clear water, and directed attention to the immediate environment - the need to clean up refuse and use deodorants in the privy.

The theory of spontaneous generation also encouraged sanitary publicists to direct their attention to the domestic hygiene of the poor. In modern parlance they regarded epidemic diseases as "lifestyle diseases" in that the poor 'chose' to live as they did. In retrospect, it is easy to see in some of their material³⁵ overtones of 'victim blaming', an attitude which the missionaries of cleanliness shared with the related temperance movement. In this respect the theory of spontaneous generation was in sympathy with the dominant ideology of the time. In a period of competitive entrepreneurial capitalism, the prevailing morality drew on both science (social darwinism) and religion (suffering as the just wages of sin) to vindicate the bourgeoisie for their affluence and to absolve them of responsibility for the poor. It may be that part of the resistance to the germ theory was due to its being in conflict with this dominant ideology. The concept of germs in the environment causing disease introduced an element of fate and circumstance and removed some of the rationale for victim blaming.

The final ascendancy of the germ theory, marked by the recantation of the Central Board of Health in 1887, completely altered the significance of metropolitan sewerage in the eyes of the suburban middle class. The possibility that water or milk could be contaminated while typhoid remained prevalent anywhere in the metropolis moved sewerage from the category of civic good works to that of vital necessity.

Political And Economic Factors

The sewerage of Melbourne was actively avoided for 40 years by decisions taken by successive state governments and municipal councils.

One such decision was the passage of the Municipal Act of 1854 which made it very easy for landowners in the suburbs to separate from Melbourne by setting up their own municipality. In doing so they were able to avoid contributing through rates to the public works needs of Melbourne and the metropolis. Instead, they were able to concentrate on local concerns.^{3,6,7}

For the next thirty-four years, suburban councils refused to participate in schemes promoted by the City of Melbourne and by the Central Board of Health. Presumably no-one thought sewerage was a bad idea, it was just that they didn't think it was a high enough priority for them.

At any time a state government could have stepped in and used its legislative power to override the self interest of the suburban councillors, set up a metropolitan board of works and arrange finance. It did not do so until 1890.

In order to ask 'why', it is necessary to ask 'who'. Who were the people who controlled state and local government during this time?

The Legislative Council, which passed the Municipal Act of 1854, was one-third appointed by the Governor and two-thirds elected by and from among the most wealthy (successful squatters and rich merchants).

Subsequent state governments were made up of the Legislative Council, which remained restricted to the wealthy, and the Legislative Assembly. Although the Assembly was elected by manhood suffrage from 1857, members were not paid until 1886 and, with one exception, did not include working class representatives until 1892.⁸

The local councils were elected from among and by the landowning rate-payers. In rich suburbs, with a high proportion of owner-occupiers, this would provide for some resident representation. In the poorer suburbs, where most of the residents were tenants, it meant the councils were controlled by local business and landlords.

Sewerage was not seen as a high priority by the middle classes. Their larger blocks of land, on well drained hillsides, were separated by distance, trees and the Yarra from the crowded, dank, lowlying, industrial suburbs.⁶ With good drainage and able to pay for an efficient pan service and garbage collection, the issue of sewerage was not seen as important.

The business community, which controlled the suburban councils, had other priorities. Commerce demanded better roads, the ego demanded impressive town halls.

The negative approach to sewerage stands in sharp contrast to the enthusiasm for railways. During the great land boom of the '80s there was tremendous pressure on state parliament to build railways in all directions. Part of the pressure came from the land speculators looking for capital gains. Part of the pressure was from local businessmen looking for the opportunities which come with settlement and development. Davison comments on the overlapping membership of the municipal councils, railway leagues, mortgage companies, and building societies of the boom suburbs of the '80s.⁶

It is worth emphasizing that among the ratepayers and councillors who were opposed to cooperating in a metropolitan sewerage scheme were speculative builders and landlords whose business activities contributed greatly to the need for sewerage. Speakers at the Inter Colonial Medical Congress of 1880 criticised jerry-built houses without adequate drainage and landlords/councillors who refused to provide basic services (cited by Cannon⁷). Prosecutions by health inspectors were rarely successful; the magistrates came from the same pool of local businessmen as did the landlords and councillors.⁷

The change of heart by ratepayers and councillors in the late 1880s may have been partly due to a new understanding of the necessity of sewerage to protect the whole community. However, Sinclair³⁶ has pointed out that cost considerations also played a part. For most households, the projected (in 1889) Board of Works rate (to pay for sewerage) would have represented a saving over the current cost of the predominant single pan collection system. As many municipalities were even then moving towards the more expensive double pan system, steep increases in night-soil collection costs were looming. In addition to the direct costs of night-soil collection, the councils were increasingly aware of the indirect costs of inspection and cleaning up after illegal dumping.

The situation was more complex than a simple cost saving because there was also a shift in the incidence of the charges from occupier to ratepayer. For home owners (and councils in suburbs with high home ownership) the cost comparisons pointed clearly to sewerage. However, for large landlords and commercial and industrial ratepayers, the increased Board of Works rate would represent a net cost. The long-standing opposition to a Board of Works by Collingwood Council with its many tenants and factories, may reflect this factor.¹⁷

While the Collingwood Council may have been controlled by landlords and factory owners, the State Government was accountable more generally and the home owners of the residential suburbs were now aware of two good reasons (cost and health) for demanding that the State Government override the remaining pockets of vested interest which opposed sewerage. The hand of the State Government in negotiations with the recalcitrant councils was strengthened by the changing attitude in the suburbs.

The possibility of a reduction in the cost of water supply with the establishment of a Board of Works was an inducement which may have led factory owners with a high water bill to withdraw their opposition to sewerage. Since 1858 the State Government had used the Yan Yean water supply to generate income by charging in excess of costs. It had been mooted that the Government might hand over water supply to

the proposed Board of Wards if the councils agreed to cooperate. It was believed that under Board of Works' management water would be cheaper.³⁶

The account so far appears to ascribe a passive role to the working class people who were living in the crowded, ill-drained, industrial suburbs.

The late 1880s and early 1890s were periods of increasing class antagonism. Unions were formed, strikes were common. Ten labour representatives (on the platform of the Progressive Political League of Victoria) were elected in the Legislative Assembly in 1892.⁶

The increasing awareness of class antagonism is illustrated in the following contemporary editorial.

"Twenty years ago the civilized world was struck with horror on seeing the defeated Communards of Paris in the frenzy of discomfiture trying to destroy the national monuments of greatness and the treasures of art, and to involve society in one common ruin. Little was it then supposed possible that in the happy Australian colonies our working classes - the most fortunate, the best paid, and the most prosperous body of workers in the world - would be summoned by their leaders to take part in a ruinous war against society, inspired by similarly desperate feelings and just as destitute of any rational purpose.¹¹ (Sydney morning Herald, 16 September 1890.)"

One might postulate that the construction of a sewerage system was a ruling class concession to the restive proletariat, providing jobs and improving their living conditions. In fact, there is little to support such a theory. Whilst there were fiery words spoken in the 1890s, the overwhelming mass of the working class placed their faith in parliamentary reform.⁶ Sewerage did not figure in the platform of the Progressive Political League of Victoria in 1891.⁸ The key planks were reform of the labour laws and a series of very specific

electoral reforms. Insofar as bourgeois control of government was a cause for the long delay in the sewerage of Melbourne, the labour demands for more democratic control over government was an appropriate response.

Politics In Medicine

The battle between the miasmatisists and the contagionists was bitterly fought, with prejudice and self interest playing as prominent a role as fact and logic. Since the influence of the theory of spontaneous generation appears to have helped to defer sewerage, it is relevant to ask why it held on so long after Budd, Pasteur, Koch and Eberth had published their findings.

Two factors appear to be important: firstly, the opposition of clinicians whose accustomed styles of practice were challenged, particularly in surgery and obstetrics; and, secondly, the opposition of hospital contributors (for a variety of possible reasons).

The implications of germ theory for surgery were first spelled out clearly by Lister in 1867³⁷ when he demonstrated that carbolic acid, used as an antiseptic, greatly reduced surgical infection. However, it was not until the '80s that these techniques (carbolicisation of instruments, hands and patient's skin) were being applied widely in Melbourne.²³ Leading Listerians at the Melbourne Hospital included William Gilbee, T.M. Girdlestone, J.H. Webb and George LeFevre. Inglis points out that at first the techniques were not applied correctly and the results were uneven. During the '70s there was continued prejudice against Listerism at the Melbourne Hospital. It was perhaps inevitable that some surgeons would fight against the germ theory rather than acknowledge that their customary practice was responsible for an unnecessarily high rate of infections. Inglis²³ refers to the surgeons who "were too old, too stubborn or too lazy to learn new techniques, who were content to perform a limited range of operations, hoping for the best". Presumably these were the surgeons

who continued to regard pus as a favourable sign, "laudable pus".

James George Beaney (1828-1891), while hardly typical, illustrates the opposition. Dr. James Beaney was a small, vain, flamboyant man who bought his election to the surgical staff of the Melbourne Hospital and paid ghost writers to write a variety of medical tracts. He was always the centre of controversy. He used to advertise his lectures to students and is remembered today for the medals and scholarships he endowed.¹³ Dr. Beaney used to operate wearing his diamonds ('Diamond Jim') and without antiseptic precautions. During the period 1880 to 1886 the coroner, Dr Richard Youl, campaigned against the Melbourne Hospital because of its appalling sanitary conditions, and the high death rate from 'hospitalism': erysipelas, septicaemia, etc. Dr. Beaney, as an avowed miasmatist, was a prominent defender of the hospital. Dr. Beaney was a member of the Legislative Council (1883-1891) and in 1886 chaired a select parliamentary committee set up (at his instigation) to investigate the Melbourne Hospital. Not surprisingly, his report rejected most of Dr. Youl's allegations. Undoubtedly Dr. Beaney MLC promoted the miasmatist view within parliament in connection with public health questions as well as questions of surgical custom.²³

The battles within Melbourne obstetrics for antiseptic and then aseptic practice have not yet been studied fully. The need for reform was certainly there. The Lying In Hospital was closed for four months in 1875/6 because of an outbreak of puerperal fever. During another outbreak in 1884, there were 16 deaths (mostly from sepsis) among 500 women admitted for delivery.³⁸ The hospital committee's solutions to the problem were miasmatist - more space between beds, more ventilation. The possibility that the obstetricians themselves were transferring infection between patients was not received with enthusiasm.

The Melbourne Hospital (from 1848) and the Lying In Hospital (from 1856) both adopted the English charity hospital model with middle class contributors having the right to elect the attending 'honorarys' as well as the Committee of Management. It may be that

the contributors' resistance to germ theory led to several of its exponents being defeated in elections for staff positions.

Dr. T.M. Girdlestone (1823-1899) came to Victoria in 1854. He initially practised in Ararat (which he represented in parliament, 1858-62). He came to Melbourne and established himself in private practice in 1862. In 1868 he became Medical Officer of Health with Melbourne City Council, a job he held until 1885. He was soon involved in prosecuting the Melbourne Hospital for its deplorable sanitary practices.²¹ Girdlestone was an active sanitarian and an early convert to Listerian surgery.^{13,21} He failed in a bid to be elected to the medical staff at the Melbourne in 1869 and went to the Alfred.¹³ However, he left the Alfred in 1877 after a dispute over the way that hospital was being run. In 1880 he was appointed Lecturer in Surgery at the University. He was subsequently (1883) elected to a position on the staff of the Melbourne Hospital but was sacked by the electors again in 1887.

James Jamieson (1840-1916) settled in Warrnambool in 1867 and moved to Melbourne in 1877. He had trained in Glasgow under Lister and was a strong advocate of the germ theory. He was appointed Lecturer in Midwifery at the University from 1879 but couldn't get an appointment at the Lying In Hospital. Jamieson's candidacy for a staff position at the Lying In Hospital was vigorously opposed by the incumbent medical staff.³⁹ The election was held within 1-2 years of the 1875/6 closure of the midwifery department because of puerperal sepsis.³⁸ Jamieson's contagionist views were well known (he published a large three-part review of the germ theory in 1876²⁹ and in a paper published in 1879 he implied that the hospital was the 'nursery' of puerperal fever⁴¹). His views and the uncompromising way in which he presented them may well have been used against him in the elections. For eight years he taught obstetrics from the outside. During this time he was highly critical of the record and practice of the Lying In Hospital in regard to puerperal sepsis.²⁹ Jamieson was elected to a junior position on the medical staff at the Melbourne (outpatient physician) in 1879 but was never elected to full inpatient physician status.²⁹ He moved to the Alfred in 1884.¹³ It

may be that his failure to get on at the Melbourne was due, at least in part, to his vigorous advocacy of Listerian surgery and the germ theory. He publicly supported Youl's criticisms of the hospital's sanitary state in 1881.²³

Another surgeon at the Melbourne who advocated antiseptic techniques was John Holden Webb whom Russell describes as 'one of the most original and progressive surgeons in Melbourne' at the time. Webb was one who saw how Lister's techniques could extend the range of surgery. In 1884 he published an account of appendicitis with perforation and advocated appendicectomy. He was removed from office by the subscribers in 1891.²³

Jamieson, Girdlestone, Webb and others. Why should the hospital contributors have been offended by these supporters of germ theory? It may have been the cost of renovating the hospitals, particularly of ensuring hygienic removal of night-soil. It may have been resistance to the implication that 'their hospitals' had been causing rather than curing infection. It may have been the ideological challenge that the germ theory offered. The sanctimonious, patronising and victim blaming attitudes of many committee members and contributors^{23,38} sat less easily with the increased role played by chance and by the environment according to the germ theory. Finally, it is conceivable that at least some of the contributors were conscious that Listerism in hospitals was linked to metropolitan sewerage and higher municipal rates for landlords and factory owners.

Clearly there are grounds for wondering whether the opposition of contributors at the Melbourne and Lying In Hospitals delayed the acceptance of germ theory and hence of sewerage in Melbourne. The rejection of known contagionists would discourage others from risking their own chances of election by publicly espousing germ theory. Given the ethics of the time, it is not inconceivable that some competitors for election would be willing to use a candidate's support for contagionism against him.

Summary

The immediate cause of the decline in typhoid deaths from 1890 was the implementation by the new Board of Public Health, through Gresswell, of a range of sanitary provisions. It appears that no single initiative was of overwhelming importance. Isolation of patients, inspection of dairies, promoting the double pan system, educating councillors, enforcing garbage collection and street cleaning, all these steps contributed to the dramatic improvement from 1890. Two significant changes underlie these developments. Gresswell had a clearer understanding of the epidemiology of the disease than did his predecessors, and the new Board had increased powers over local government.

The construction of the sewerage system commenced in 1892 and from the turn of the century the provision of sewerage and the installation of water closets contributed greatly to the control of typhoid. The decision to proceed with sewerage from 1890 stemmed from two important developments in the 1880s: firstly, the cost of the pan system for night-soil collection came to exceed the projected cost of sewerage; secondly, the widespread adoption of the germ theory advanced the perception of sewerage as a means of protecting the whole community from typhoid.

It seems likely that medical practice (meaning the standard methods for the treatment of typhoid cases) did not contribute greatly to the control of typhoid during the period in question. In fact it is more than likely that careless disposal by hospitals of contaminated faeces may have contributed to the spread of the disease before sewerage was finally connected.

In another sense, medical practice was important in controlling typhoid. The prolonged adherence by the bulk of the profession to the miasma theory (for reasons discussed earlier) provided important theoretical support to those who, for other reasons, opposed sewerage. It is not easy to dissect out the different factors which led to the conversion of the profession in Victoria to the germ

theory. The spirited exposition of the theory and presentation of overseas research results by Jamieson, Thompson, Pearson and others was an important influence. Equally significant was the careful epidemiological work of Harry Allen and country practitioners, such as Hunt and Colquhoun, referred to earlier. This work provided local support for overseas findings.

Clinical practice provided several important arenas (Listerian surgery, puerperal sepsis, hospital infection) in which the germ theory-miasma debate was finally resolved. The reluctance of many doctors and hospital contributors to accept germ theory may have retarded its community wide acceptance and hence the introduction of sewerage.

Public health authorities had been calling officially for sewerage from 1848. Why was it not until 1890 that their advice was heeded? How important were the health considerations or was it more a reflection of evolving social and economic relations?

It appears that the conversion of the medical profession to the germ theory played an important role in that filth and stink came to be seen as a threat to middle class health rather than just a natural condition of the poor. The typhoid epidemics of the late 1880s ensured that this changed understanding would be translated into practice.

During the same period, increased urban density, price changes and tighter public health regulations had switched sewerage from being the expensive option to being cheaper than the pan system, especially for home owners and residential municipalities.

However, the changes in medical theory and the economic arguments must be seen against a background of evolving political relations. The apparatus of government, initially in the hands of the squatters, was by the mid '60s dominated by the urban small capitalist. In their singleminded pursuit of personal gain, public works such as sewerage were given low priority. The population growth of the '80s created a

significant home owning middle class with considerable electoral influence. Once this group was convinced of the need for sewerage, the pressure, primarily through State parliament, was considerable.

With the end of the boom and the collapse of the speculators (and many small businesses), the political hegemony of the larger (and more far-sighted) financial interests was established. Meanwhile, the continuing progress to democratic reform (eg, payment for members from 1886) and the growth of trade unions in the 1880s provided a counter-vailing force which represented more strongly the interests of the working class. On the question of sewerage, it seems that by 1889 the interests of the better organised working class (improved living conditions) coincided with those of the home owning middle class (safety from typhoid, cheaper night-soil disposal) and of the increasingly powerful, larger capitalists (longterm stability and more rational urban development).

Conclusions

The present inquiry started with two general questions:

Improvements in health: due to improved medical practice or changes in the way we live?

Changes in the way we live: due to public health activities or evolving technology and economic and political relations?

At least insofar as this case study is concerned, the first conclusion is that these are oversimplistic alternatives.

The improvement in health (in this case, the fall in typhoid mortality) was not due to improved methods of treatment but to improved public health regulation and sewerage. Case notification, improved isolation and control of contacts were improvements in clinical practice which reflected the public health developments. On

the other hand, the environmental changes (control of milk and water supply, sewerage) were, in a sense, due to improvements in medical practice in more distant areas of medicine insofar as the triumph of germ theory in surgery and obstetrics contributed to its community wide acceptance.

The environmental changes which led to the control of typhoid were not due to any single factor but were due to complex interactions between the public health viewpoint, economic values, and political relations as they evolved with time. Some of the interactions between these three strands have been traced earlier, for example, the way tighter public health regulations increased the cost of the pan system and made sewerage the cheaper option. Another important interaction was between the evolving political climate and the way in which the public health view was expressed. The authoritative voices of the public health interest in the present case study were constrained in several ways: by their direct accountability (eg, the contributors' votes against the Listerians at the Melbourne Hospital), by informal pressures from their peers (eg, the condemnation of Thompson by the Australian Medical Journal) and by the preconceptions and prejudices of the experts themselves.

Two questions of general importance to contemporary preventive medicine have been explored through one historical case study. There are obvious parallels between the typhoid/sewerage story and more modern cases such as the decline in deaths due to heart attack and stroke. However, the dangers of generalising are obvious. Modern problems such as heart disease, stroke, tobacco, road trauma, toxic chemicals are in many specifics quite different.

If we are looking for generalisations of wide and current application in preventive medicine and public health policy, the analysis of more than one case study is called for. The potential value of historical case studies in developing such general guidelines can be illustrated with reference to medical research, health education and the role of the clinician.

In the typhoid and sewerage case study, local medical research particularly that of Jamieson and Allen) played a critical role in communicating, interpreting and corroborating overseas findings. Conversely, the delay in sewerage could be attributed in part to barriers to local research activity. In 1874 William Thompson wrote to 160 doctors in and around Melbourne asking, among other things, for access to their typhoid cases. Only 48 replied and of these only one agreed to his studying his patients and their circumstances.¹⁰ Two modern parallels also worth studying in this connection are the obstacles which delayed adequate research in asbestos related diseases and the powerful impact of the research findings linking tobacco smoking and lung cancer. The question is not whether research can contribute to prevention, but how to ensure that it does.

In 1884 the ladies of the Australian Health Society mounted a series of 'Meetings for the Wives and Daughters' (of the Poor) in Collingwood.³⁵ The topics covered included food, care of infants, personal hygiene and cleaning up one's own immediate surroundings. The lectures do not appear to have mentioned the need for underground sewerage or the fact that the local council was one of the major bulwarks of resistance to a metropolitan board of works. By presenting only part of the story the ladies of the AHS were expressing their own attitudes about the proper ordering of society. Bravely ignoring the smell, they chose to neglect the class dimensions of the sewerage problem. Perhaps the women of Collingwood would have seen those issues as primary. In the same year (1884) the Inter Colonial Trade Union Congress resolved that:

"Class questions require class knowledge to state them and class sympathies to fight for them."⁸

A strong modern parallel exists in relation to aboriginal health. Many white health authorities and health workers have tended to see the problem in fairly narrow terms (domestic hygiene, alcoholism, housing). Aboriginal activists claim that health is secondary to fundamental economic, cultural and political issues such as land rights.⁴⁰ Both cases point to a polarity within health education,

ranging from oppressive and manipulative to liberating and enabling.

Medical practitioners exercise considerable influence in the preventive field as clinicians, as lobbyists and as publicists. Many competing preventive strategies have indirect implications for clinical practice. How significant is clinical conservatism in retarding prevention? In the present case study, conservatism in surgery and obstetrics may have been an influence. A modern parallel could be the reluctance of some treatment-oriented doctors to support nutritional policies aimed at the primary prevention of hypertension and heart disease.

The conditions which determine the public health are the structures and processes of society generally. There are no effective long-range strategies for improving public health which do not ramify throughout society. The historical study of improvements in health can help to clarify these interrelationships and provide guidance to those seeking to improve health and society.

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