

DEATH BY WATER:

JOHN SNOW AND CHOLERA IN THE 19th CENTURY*

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John Snow's contribution to the establishment of the specialty of epidemiology is well-recognised and he is remembered primarily in this context for the discovery that cholera was a waterborne infection. This paper examines the development of Snow's theory of the mode of communication of cholera and considers his contribution to early epidemiology.

Cholera 1831-32

The first confirmed case of cholera in Britain occurred in the autumn of 1831 when William Sproat of Sunderland contracted the disease. Over the next thirty years or so, Britain was invaded by four of the pandemics of cholera which had spread from Bengal since the early nineteenth century, and suffered epidemics in 1831-32, 1848-49, 1853-54 and 1866.¹ Although cholera was not as persistent or frequent in its attacks as other fevers of the time, it was the high percentage of deaths from the disease and the speed with which fatalities could occur which accounted for the perception of cholera as a 'shock disease.'² In terms of the overall number of deaths for example, cholera claimed only around six per cent of deaths for 1832. This put it no higher than third in the table of leading causes of death — behind consumption and convulsions and not far ahead of typhus, pneumonia, smallpox and drowsy. Public and professional reaction to the onset of the cholera epidemics was one of panic. Medical journals such as the *Lancet* set a tone of alarm when its editorials referred to cholera as raging with 'unabated virulence'.³

* Based on a paper delivered to the Liverpool Medical History Society on 4 March 1999.

1 See for example, R.J. Morris, *Cholera 1832*, (London: Croom Helm, 1976) and Margaret Pelling, *Cholera, Fever and English Medicine, 1825-1865* (Oxford: OUP, 1978).

2 Morris, p. 12 and Anthony S. Wohl, *Endangered Lives, Public Health in Victorian Britain* (Cambridge: CUP, 1983), pp. 118-19.

3 *Lancet*, I (1831-32), 309, 669.

Doctors were able to offer little or no reassurance to the public and frankly admitted that there was no agreed treatment for the disease. Therapeutic advice focused only on the very basic treatments of the day, including bleeding, hot air baths, ammonia, galvanism, the use of mercury, purging and vomiting and large doses of calomel.⁴ The perception of cholera as a 'new' disease caused much anxiety within medical circles. At a time when medical practice was concentrating on the elimination of uncertainty through agreed classifications of disease and its treatment, such a thing as a 'new' disease threatened to undermine the basic focus of medical practice. In June 1831 a Central Board of Health was set up but it had only advisory powers and was no more effective than medical practitioners at controlling the epidemic.⁵

The crux of the medical argument revolved around the contagion or non-contagion of the cholera. The contagionists argued that disease could spread through the atmosphere and supported measures to quarantine incoming ships to British ports. Some ships were indeed quarantined but such action disrupted trade and transport and was not popular.⁶ (In 1853 Snow explained that he believed it was the pecuniary interests involved in this question that led doctors to disagree so acrimoniously on this point in the 1830s). The anti-contagionists promulgated the pythogenic theory of disease which focused on the spread of disease arising from the bad smells from accumulated organic matter and waste products in the streets. Snow was dismissive of both these viewpoints.

The measures taken by government after the 1831-32 epidemic were scant to say the least. The Central Board of Health wrote complacently that the management of cholera must be left to the 'prudence and good feeling' of the communities where it appeared. Cholera played no part in social policy making over the next decade and was not mentioned in the Poor Law Commissioner's Report of 1834 or any other major report of the period. There appear to be two main reasons for such inaction. First, the anticipation of the consequences of the first cholera epidemic had been greater than the reality; suggestions that cholera had the power to create massive social and commercial disruption simply did not come to fruition. Second, the lack of medical agreement on the treatment and prevention of the disease meant that the authorities had no clear direction to follow. Nevertheless, the 1831-32 epidemic did leave its mark by emphasising the importance of cleanliness and ventilation, and the experience of creating and running such bodies as the

4 *Ibid.*, 445, 447, 681, 713; *ibid.* II (1831-32), 52.

5 See Morris.

6 *Lancet*, II (1830-31), 769.

central and local boards of health, however inadequately, did set a precedence for future action.

Communication of theory

The second major epidemic of cholera began in Scotland in October 1848 but did not establish itself in London until February 1849.⁷ In relation to the number of fatalities, this was the most serious of all nineteenth-century epidemics and about 53,000 deaths were registered for England and Wales, compared to around 20,000 for the 1831-32 epidemic.⁸ Between 1845 and 1856, over 700 individual works were published in London on the subject of cholera.⁹ The majority of works published in this period were primarily concerned with explaining the causes of the disease and the way in which epidemics could be prevented from spreading, although medical journals were critical that none of them offered any real progress.

Snow publicised his views on cholera in a thirty-one page pamphlet which appeared on 29 August 1849. It was the start of a prolific output on the subject. He began by drawing clinical observations from the cholera cases he had seen and heard about. As a medical apprentice he had treated the miners at Killingworth Colliery who suffered from cholera during the first epidemic. This had led him to make several observations which were central to his contention that cholera was a waterborne disease.¹⁰ The first part of his theory related to the pathology of cholera. He argued that cholera was, in the first instance, a local infection of the mucous membrane of the alimentary canal. He posited that the cholera poison was introduced into the alimentary canal and that the disease passed between patients through the accidental swallowing of the cholera poison (found in diarrhoea) which then multiplied itself in the stomach and bowels.¹¹

Snow extended his argument to public water supplies as he believed that cholera evacuations contaminated the water used for drinking and culinary purposes, 'either by permeating the ground and getting into wells, or by running along channels and sewers into the rivers'.¹² He concluded by offering advice on the avoidance of the disease, stressing the necessity of

7 *Ibid.*, I (1849), 130.

8 Morris, pp. 12-13.

9 Pelling, pp. 4-5.

10 The link between poor sanitation and the spread of cholera in the mines was one of the most important of his observations (*London Medical Gazette* [hereafter *LMG*], IX (1849), 749).

11 *LMG*, IX (1849), 745-52.

12 *Ibid.*

scrupulous personal hygiene, and also included advice to miners for splitting their work into two shifts in order to avoid taking food into the pit.¹³ The exclusion of any traditional medical therapeutic advice underlines the shift that had taken place in his thought: his concentration was rather upon the prevention of cholera through improved sanitary conditions which could only be achieved through public health information, and he specifically related instances where cholera coincided with the conditions to be found among the poorer classes. Here Snow is linking the disease and its environment and the social conditions which govern that environment. This connects very obviously to the approach of Edwin Chadwick's report of 1842 which shifted the debate on the causes of poverty away from moral issues to environmental and social ones.¹⁴ Snow presented this thesis thirty-four years before the German researcher, Robert Koch, identified the micro-organism as the *cholera vibrio*.

The summer of 1849 was an important time for many involved in the study of cholera and the theory which gave most credence to Snow's speculations was the cholera-fungus theory. This theory had developed as a result of the findings of a group of Bristol doctors who had undertaken microscopical analyses of the evacuations of cholera patients.¹⁵ Members included Dr William Budd, Dr Joseph Swayne and Dr Frederick Brittan. The result of the Bristol team's investigations was the discovery of 'bodies' in cholera evacuations. These bodies were found to be particular to choleraic matter and were also found in different stages of development. Budd extended his researches to water analyses and was able to detect 'the same organisms in almost every specimen of drinking water' which he had obtained from cholera districts.¹⁶ When Budd published his *Malignant Cholera* at the end of September 1849 he gave Snow credit for identifying the waterborne nature of the disease.¹⁷ Snow accepted that Budd's researches tended to confirm the view that cholera was a specific infection of the alimentary canal, but he was much more reluctant to accept that the cholera organisms were able to exist for a short time in air, and believed there was no reason to modify his views to include a fermentation

13 *Ibid.*, 929.

14 Edwin Chadwick, *Report on the Sanitary Conditions of the Labouring Population of Great Britain* (London, 1842).

15 Pelling, pp. 156-75.

16 William Budd, *Malignant Cholera* (1849), p. 4.

17 Budd, pp. 11 and 19. See also Budd's letter to the *Times*, 26 September 1849.

theory.¹⁸ The cholera fungus theory only maintained viability until the publication of the Royal College of Physicians' report on the subject in November 1849. This concluded that 'the whole theory of the disease which has recently been propounded, is erroneous, as far as it is based on the existence of the bodies in question'.¹⁹

Snow was knowledgeable in the field of chemistry and certainly, in support of his work on anaesthetics, he undertook many rigorous practical experiments. However, in relation to cholera, the only practical exercise he undertook was the examination of some water collected from the tank behind one of the houses in Albion Terrace which suffered from a severe outbreak of cholera in September 1849. He allowed it to stand for twelve days after which time he reported that he had filtered it through paper, and evaporated it, thus proving that it contained soluble organic matter.²⁰ The question has to be asked, therefore, why he did not pursue further practical investigations himself. The answer illustrates one of Snow's crucial strengths. He accepted the limitations of medical science to identify the cholera poison; instead, he transferred his energies to investigating the transmission of such poison. It was this change in direction which brought his work into the fields of epidemiology and public health, and singled him out from those doctors who were unable to broaden their perspective.

Statistical proof

The second edition of *On the Mode of Communication of Cholera* was published in January 1855. A much larger volume than the 1849 pamphlet, it differed little in its theory that cholera was primarily transmitted through water. What was new in the book, though, were the two sets of data relating to investigations which Snow had undertaken during the 1854 outbreak of cholera in London. The first related to the outbreak in Broad Street, close to Frith Street where he had lived until the previous year. The second investigation was one which he had begun in 1849 and related to the supply of water to south London by the Southwark and Vauxhall and the Lambeth water authorities.

In 1854, Snow was living in Sackville Street, Piccadilly, about ten minutes walking distance from Broad Street, Golden Square and Berwick Street. A few cases of cholera occurred in the last part of August but the main epidemic started during the night of 31 August and 1 September. He

18 *Lancet*, II (1849), 431; *London Journal of Medicine*, I (1849), 1077-8; *Lancet*, I (1856), 184.

19 *Lancet*, II (1849), 493.

20 John Snow, *On the Mode of Communication of Cholera* (London, 1849), pp. 19-20.

described it as 'the most terrible outbreak of cholera which ever occurred in this kingdom'. It was an outburst that claimed over 500 lives in ten days, and he believed there would have been more fatalities had the population not left the area as quickly as they did. As soon as he became aware of the outbreak he turned his attention to the local water supplies and became suspicious that there was 'some contamination of the much-frequented street pump in Broad Street'. On 3 September, he collected some samples of water from the pump for analysis. However, it showed so little impurity that he hesitated to come to a conclusion. Over the next couple of days he did identify some 'small white flocculent particles' and decided to investigate the situation thoroughly. This investigation comprised taking a list from the Registrar General's Office of the deaths from cholera which had been listed during the week ending 2 September. He then undertook detailed enquiries into the circumstances of each death in the area to ascertain where the deceased had obtained their drinking water. In 83% of the cases he found that the dead had been in the habit of drinking the water from the Broad Street pump. Once he was convinced that he had found the source of the contaminated water which had led to the outbreak, he attended a meeting of the Board of Guardians of St James's parish on 7 September and informed them of his conclusions. He recorded that 'in consequence of what I said, the handle of the pump was removed on the following day'.²¹

This incident has been handed down through generations of historians and epidemiologists as clear proof of the way in which Snow dramatically halted the appalling outbreak of cholera. As with many such anecdotes, the facts themselves need to be looked at more closely. The ferocity of the cholera attack was on the wane by the time Snow attended the vestry meeting and he himself acknowledged that by 8 September, the date on which the pump handle was removed, it was impossible to decide whether the well still contained the cholera poison in an active state.²² The significance of this event was that it acknowledged Snow's authority on the subject. It is likely that the meeting of parish officials did not accept Snow's theory in totality, but his conviction carried weight and they acted. It is an excellent example of medical authority working with local government to prevent the spread of disease within the community.

Following the outbreak, the medical committee of the General Board of Health carried out a local enquiry on behalf of the government. One of the accounts presented to the enquiry had been prepared by the Reverend Henry Whitehead, curate of St Luke's parish church. Whitehead had published his

21 John Snow, *On the Mode of Communication of Cholera* [hereafter *On Cholera*], 2nd ed. (London, 1855), pp. 38-40.

22 *On Cholera*, pp. 51-52.

own account of the outbreak that autumn and included in it mortality figures for each street in the parish which he had compiled himself.²³ Both Whitehead's account and Snow's investigation into the contaminated water-pump were presented to the inspectors. Snow's evidence, in particular, held no sway with the officials. They dismissed contagion or contaminated water as possible causes of the outbreak, recording that the outbreak of cholera could not be attributed to 'any communication of the disease from person to person either by infection or by contamination of the water with the excretions of the sick'.²⁴

In 1849, the *London Medical Gazette* had suggested that in regard to Snow's theory, the *experimentum crucis* would be if the water conveyed to a distant locality where cholera had been hitherto unknown, produced the disease in all who used it.²⁵ One of the cholera victims Snow had traced through his Broad Street investigation was a widow who lived in Hampstead. She had a regular delivery of water from the Broad Street pump as she preferred its taste. Her last delivery was made on 31 August and by 2 September, having drunk the water, she had died from cholera. Snow regarded this as 'the most conclusive' of circumstances in proving the connection between the water pump and the cholera outbreak.²⁶

Despite all this evidence it still looked as though Snow's theory was to develop no further support. This would have remained so had it not been for the action of Edwin Lankester, a fellow member of the Medical Society of London and vestryman at St Luke's.²⁷ Lankester established a Cholera Inquiry Committee to look into the recent outbreak. Between 25 November 1854 and 25 July 1855, it held 14 meetings and produced a final report with sections written by Snow and Whitehead. It was Whitehead who was to produce the definitive proof to substantiate Snow's theory. Snow had sent a copy of *On Cholera* to Whitehead who, having read it, wrote to its author stating that in his opinion, an intensive inquiry would reveal the false basis of Snow's argument, and the inaccuracy of attributing the spread of cholera to the Broad

23 Henry Whitehead, *The Cholera in Berwick Street, London in 1854* (London, 1854). Also see, Sidney Chave, 'Henry Whitehead and Cholera in Broad Street', *Med. Hist.*, 2 (1958), 92-108.

24 General Board of Health, Report of the Medical Council to the Rt. Hon. Benjamin Hall in relation to the cholera epidemic of 1854 (London, 1855), p. 7.

25 *LMG*, IX (1849), 466.

26 *On Cholera*, p.44. He also identified several groups who had escaped cholera by using alternative water supplies (pp. 42-43).

27 Snow had known Lankester for several years and had administered chloroform to Mrs Lankester in 1853, 1855, 1856 and 1858.

Street pump.²⁸ Whitehead's *Special Investigation of Broad Street* was presented to the committee in June 1855. It traced as many residents of the area as possible and gathered details such as the name, age, position of rooms occupied, the sanitary arrangements, the water source, and the time of the attack. Whitehead reported that 'slowly and I may add reluctantly, the conclusion was reached "that the use of this water was connected with the commencement and continuance of the outburst"'.²⁹ Whitehead was also responsible for tracing the original source of contamination of the water-pump at the commencement of the outbreak. He happened to notice a return of death for an infant suffering from diarrhoea on 2 September. What alerted him to the significance of this finding was that the child's house was closest to the pump. On enquiry, it was revealed by the child's mother that she had emptied water from soiled napkins into the cesspool at the front of the house.³⁰ The Committee ordered an inspection of the well to be made in June 1855, and this revealed beyond all doubt that faecal matter had seeped through the decayed brickwork of the cesspool to the well which was less than three feet away. The Committee therefore reached their conclusion that the outbreak was in some manner attributable to the use of impure water of the well in Broad Street.³⁰

The second of Snow's investigations began during the previous epidemic in 1849 when he began to consider the water supplies to London houses. Although many London households still depended on drawing water from public wells such as the one in Broad Street, an increasing number had bought mains water supplied by private, profit-making water companies. Snow had noticed that the cholera fatality rates in 1849 were particularly high in the areas supplied by the Lambeth and the Southwark and Vauxhall water companies. At this stage, both companies obtained their water from a point in the Thames which was heavily polluted with sewage. In 1852, the Lambeth water company had moved its waterworks to Thames Ditton, thus obtaining a supply of water quite free from the sewage of London, whilst the Vauxhall company continued to draw its water from the sewage-laden Thames at Battersea Fields. By 1854, these two companies supplied around two thirds of the population of south London. Snow undertook an investigation to calculate the number of deaths from cholera per 10,000 houses during the first seven weeks of the 1854 epidemic. He began his enquiry in the middle of August 1854 and having found that 38 houses out of the 44 where deaths from cholera

28 Chave, p. 96.

29 *Ibid.*, pp. 96-97.

30 *Report on the Cholera Outbreak ... by the Cholera Inquiry Committee* (London, 1855), p. 83.

had occurred were supplied with water from the Southwark and Vauxhall water company, he communicated these facts to William Farr. Farr was as struck with the result as Snow and so ordered his registrars in all southern districts of London to make a return of the water supply of the house in which the attack took place in all cases of death from cholera. As a result of these researches, Snow concluded that the mortality rate for the houses supplied by the Southwark and Vauxhall water company was between eight and nine times greater than for houses supplied by the Lambeth company.

In Snow's opinion, both investigations presented substantive evidence of the theory he had been promulgating since 1849. But, as we shall see, this was not the opinion of either the medical profession or the public health officials.

The communication process

Snow was an active participant in the Medical Society of London and the Medico-Chirurgical Society, and was a founder member of the Epidemiological Society, established in 1850 in the wake of concern about the 1848-49 cholera epidemic.³¹ During the early 1850s, Snow took every opportunity possible to draw attention to his theory, presenting papers at medical societies and writing to journals to explain how contaminated water could have been the source in cholera outbreaks.³² The key message to the medical profession was that it was essential to ascertain the causes of any disease in order to gain the knowledge necessary for its prevention. In an article 'On the Prevention of Cholera', published in 1853, he wrote that:³³

we cannot hope to prevent any disease unless we have a correct knowledge of its causes. As regards the cholera, many persons ... attribute its continued existence and extension entirely to neglect of the requisite measures for its suppression. ... a great deal has been done within the last twenty years in the way of presumed sanitary improvement ... yet the cholera of 1849 was much more fatal than that of 1832, and now, on its third visit to our shores, it is prevailing to a more fatal extent in Newcastle than was ever before witnessed in this country. These circumstances clearly show, that the causes of cholera are not generally well understood, and that the true preventive measures have not been applied.

31 The original suggestion for its name was the Asiatic Cholera Society. See David E. Lilienfeld, 'The Greening of Epidemiology', *Sanitary Physicians and the London Epidemiology Society*, *Bull. Hist. Med.*, 52 (1979), 503-28.

32 John Snow, 'Cholera at Albion Terrace', *LMG*, IX (1849), 504-05; 'Sickness and Mortality in the Crimea', *Medical Times & Gazette* [hereafter *MTG*], X (1855), 457-8; 'Outbreak of cholera at West Ham', *Lancet*, II (1857), 419.

33 *MTG*, VII (1853), 367-69.

He explained how and why cholera is transmitted through water and finished by listing ten hygienic measures which should be adopted in an outbreak of cholera. He urged that the public be made aware of the communicability of cholera on the basis that the knowledge that it was a 'catching' disease, which might generally be avoided by a few simple precautions, was much less pessimistic than the opinion which supposed its transmission to depend on 'some mysterious state of the atmosphere in which we are all of us immersed and obliged to breathe'.³⁴ The crux of this argument was also present in a paper 'On the Principles on which the Treatment of Cholera Should be Based', presented to the Medical Society in January 1854.³⁵

In all discussions Snow held his ground and continued to relate the clinical and epidemiological facts which had led him to his supposition on cholera. When he disagreed with other speakers, he always substantiated his point with reference to pathological or statistical facts.³⁶ Forbearance appeared to be one of his strengths but it is evident that he found the attitude of the profession to his work frustrating. This is shown quite forcibly in three letters to medical journals in the August and September of 1854, written at the time he believed he had obtained firm proof of his theory. The first letter comments on the link between the outbreak of cholera in London and the Baltic Fleet. He refers to the previous papers he has published on the transmission of cholera and answers the objection that the cholera poison would be rendered inert by large-scale dilution in water. His refutation of this objection was couched in, what was for him, a very sharp tone indeed. He wrote:³⁷

a substance cannot be diluted beyond the ultimate particles of which it consists. The morbid matter of cholera, like the pus of smallpox and other morbid poisons, owes its properties, no doubt, to cells; and there is no more reason why diluting with water should necessarily destroy their activity, than that it should destroy the ova of fishes; and there is also no reason why every one who dips a pail into the water should draw a prize.

At the same time, Snow was working on his investigation into the communication of cholera by Thames water. He wrote a buoyant letter to the journal to publicise the initial findings from his enquiry which promised 'to

34 *Ibid.*, IX (1853), 369.

35 This is the only occasion on which Snow offers therapeutic advice.

36 *Lancet*, II (1854), 420.

37 *MTG*, IX (1854), 170.

yield very conclusive evidence indeed'. His motivation for doing so, at such an early stage of the work, was that the results were³⁸

too important to be withheld from the Profession at a season when every week is adding so much to the mortality from cholera.

The third letter in this group reported his work on the cholera outbreak in Golden Square. He wrote confidently and clearly of his investigation into the Broad Street water pump as the source of contamination and ended by reminding readers that the final results from his enquiry into Thames water (not then published) showed that in³⁹

the population having the impure water of the Thames, ... the mortality from cholera has been ten times as great as among the population having the improved water.

The knowledge that the theory which he had been proposing for over five years, had finally been substantiated to his satisfaction, added an unmistakable air of confidence to his communications. It also resulted in more frustration when he realised that despite what he believed to be confirmatory evidence, the profession would still not accept the theory without reservation.⁴⁰

The reviews of the 1855 edition of *On Cholera* acknowledged the importance and quality of Snow's work and accepted the evidence that cholera was communicable. Yet none would acknowledge the proof that the specific cholera poison was transmitted through water and that, in most cases, this was the primary source of the disease in epidemics. The *Medical Times & Gazette* hoped that his work would encourage others in the same field so that the question he had raised on the communication of cholera 'may be absolutely answered'.⁴¹ The *Lancet* welcomed the influence of such a book on sanitary reform and commented that, in regard to his point that cholera evacuations were mixed with water used for drinks and culinary purposes, it was 'impossible to overestimate the importance of the doctrine contained in this passage'.⁴²

The cost of publishing *On Cholera*, £200, was borne by Snow himself. Only 56 copies were sold, for which Snow received the proceeds of £3 12s.

38 *Ibid.*, 247.

39 *Ibid.*, IX (1854), 321.

40 *Lancet*, II (1855), 122.

41 *MTG*, X (1855), 92.

42 *Lancet*, II (1855), 524-25.

He sent the book to his brother Robert who had supplied him with the information about collieries, and to several of his friends and colleagues including George Budd, brother of William.

The confidence Snow had in the accuracy of his own theory was unshakeable. He was remembered for this after his death by Whitehead who said that he would speak in a 'calm prophetic way', of the ultimate results of the doctrine which he laid down:⁴³

'You and I', he would say to me [Whitehead], 'may not live to see the day, and my name may be forgotten when it comes, but the time will arrive when great outbreaks of cholera will be things of the past; and it is the knowledge of the way in which the disease is propagated which will cause them to disappear'.

The particular reasons why Snow found it so hard to convince his colleagues of the accuracy of his cholera theory were twofold. First, the absolute specificity of his theory allowed no room for expansion to consider any other cause of propagation of cholera than through water.⁴⁴ This arose as a result of his belief that the only way to prevent epidemics such as cholera was through public health measures and, as water was the primary source of contamination, this should be addressed first. Second, Snow's definition of science as a set of finite truths, which were not open to debate or amendment, resulted in the adoption of an intractable position in regard to his theory. The pathological and epidemiological proof of his theory on cholera could not be faulted, he thought. Therefore, the only way open to him, as he explained to Whitehead, was simply to wait until the rest of the medical world recognised this set of truths. By maintaining such a position, he provides a strong example of the strength and cohesion with which some practitioners applied scientific principles to their practice of medicine during the nineteenth century.

Public health and epidemiology

Snow's logistical approach to cholera can be split into definitive areas which match those specified by modern epidemiology. He elucidated the mode of communication of cholera on pathological grounds; this was then evaluated numerically and statistically by the 1854 investigations, and he concluded by suggesting various preventative measures. Other than the extension of the methodology to include all disease types, this is representative of the modern approach to epidemiology. Snow then developed a general interest in water and its purity, and in other public health issues such as nuisances and the adulteration of food. These latter pieces of work

43 Henry Whitehead, *Experiences of a London Curate* (Clapham, 1874).

44 E.A. Parkes, *A Manual of practical Hygiene* (London, 1864), p. 57.

demonstrate the qualities shown in his writings on cholera: an adherence to the truths deduced through pathological and clinical principles and preventative measures in the form of public health.

Snow's belief that each epidemic disease was propagated through the specific poison of that disease being communicated from one body to another was maintained in opposition to the views of many medical men who continued to favour the pythogenic theory of disease. This difference of opinion became most apparent when he was called to give evidence before the Select Committee on the Public Health and Nuisances Removal Bill.⁴⁵

In 1856, in order to prove his theory Snow undertook a study into the supposed influence of offensive trades on mortality. In this he compared the rate of deaths per 10,000 people of those working in offensive trades as compared to other professions. His conclusion was that 'the vicinity of offensive factories leaves the cholera to pursue the same course that it would do in their absence'.⁴⁶ A year later, in his paper 'On the adulteration of bread with alum', which he had linked to the development of rickets in children, he advised that the way to eliminate such practices was for the⁴⁷

committees of the public hospitals and the guardians of the poor to oblige the bakers who contract to supply their respective institutions to furnish an unadulterated article.

So the relationship between the epidemiologist and society emerges as one in which the role of the doctor is to use his medical knowledge to formulate preventative recommendations which society, in the form of local government, is empowered to implement. The work is supported and sustained by the data of the social scientists.

One of the most important demonstrations of the commitment Snow had to promoting the specialty of epidemiology was that in his oration to the Medical Society of London in 1853 he chose to speak on the subject of communicable disease. No restrictions were imposed on orators by the Society other than that the subject matter should refer to the Society or medical science. His oration discusses the basic philosophical principles which acted as a framework for his theories of disease causation. He illustrates how the influence of scientific medicine had altered the perception of epidemics. Epidemics used, he said, to be attributed to factors such as atmosphere, just as political and social events were perceived to be governed by the movement of the planets. However, this belief had changed as a result of a better

45 *On Cholera*, p. xxxix.

46 *Lancet*, II (1856), 95-97.

47 *Ibid.*, II (1857), 5.

understanding of the composition and physical properties of air. This is an excellent example of the distance he believed there was between the practice of 'new' scientific medicine and the unscientific medicine of previous decades. He believed that the prevention of epidemic or communicable diseases deserved increased attention from the medical profession as:⁴⁸

these diseases influence the life, the death, and the numbers of the human race, more than all other causes.

Presenting his oration on this subject was Snow's way of focusing attention on this area. There are no accounts of the reception of his speech, but he concluded by reminding his colleagues that it was through the investigation of an epidemic disease, smallpox, that Jenner, a former fellow of the Society was enabled to make 'the greatest discovery that has ever been made in the practice of medicine', and to render the greatest benefit to his species which they had probably ever received. This accolade to Jenner summarises the reasons for Snow's own devotion of his time to epidemiology. It was a specialisation which he believed could have the maximum impact on the quality of human life and as such, he, as a doctor, was obliged to pursue it to the best of his abilities.

Conclusion

Cholera focused attention on public health issues such as water supply, sanitation arrangements, housing and work conditions, as did other nineteenth-century epidemic diseases. The health of the community became a priority for government and medical action, as a result of which, two new sciences — epidemiology and public health — were established. Collaborative working between government and medicine was key to the success of such initiatives. The emerging social scientists such as Farr used the newly established sources of health statistics to investigate areas which required appropriate governmental action; medical practitioners contributed their pathological, microscopical and epidemiological knowledge of cholera. Their joint efforts gradually determined a programme of preventative measures.

The science of epidemiology focused on the general character of a disease and its manifestation as an epidemic, rather than upon single cases. This represented a significant shift away from eighteenth-century medical thought, and medical practitioners differed in their reaction to such developments. Those, such as Snow and Budd, who were able to absorb the new thinking and use it as a catalyst to progress their own medical knowledge, welcomed the advances it made possible. Snow's 1854 investigations represent the first examples of modern epidemiological cohort, or incidence,

48 John Snow, *On Continuous Molecular Changes* (London, 1853).

studies and were the result of his implementation of the new medical thinking to epidemic disease. The establishment of epidemiology as a new specialty, and in particular, Snow's struggle to achieve recognition for his cholera theory, epitomise many of the crucial battles that were being fought in the areas of medical knowledge during the mid-nineteenth century.