Cholera: The Work of William Farr and John Snow

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Preface

The following paper was submitted in partial fulfillment of the requirements in Epidemics in World History, a Graduate level course, at Millersville University, spring 2007. If anyone would like to use it in their research please email me

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The technical name for cholera is *Vibrio cholerae* (*V. cholerae*). Interestingly, the *V. cholerae* bacterium itself is harmless to humans. For the bacteria to be harmful to humans it must be ingested, then *V. cholerae* needs to find its way to the small intestine. Once in the small intestine, it interferes with one of the small intestine's main functions; that is, to maintain the body's overall water balance. There are two types of cells that line the walls of the small intestine: cells that absorb water and pass it on to the rest of the body, and cells that secrete water that ends up as waste. *V. cholerae* fools the cells into expelling massive amounts of water. This happens at such a high rate that in extreme cases infected people can lose up to thirty percent of their body weight in a matter of hours.[1]

Such a debilitating disease led to changes in society and medicine. Historians of cholera have focused on the changes in society and medicine brought about by the disease. In the process, no matter how much or how little of the story of cholera is told, the names of two men are found most of the time, John Snow and William Farr. The following is an analysis of how some historians have treated William Farr's and John Snow's work. Through the analysis, it will be seen that although historians have different points of view on the work of Snow and Farr, the work of both men was crucial in the battle against cholera.

In order to understand each man's importance in the battle against cholera, it is necessary to provide some background. *V. cholerae* was working its way from India to England, leaving fifty million dead in its wake. In 1831, Britain was the perfect place for an epidemic because it was in the middle of the Industrial Revolution, with the population growth that implies. According to James Burke in the program *What the Doctor Ordered,* from the series *The Day the Universe Changed*, in the ten years from 1821 to 1831 the

[1] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006), 37.

population of Britain had risen from nine to fourteen million. These people were jammed into the cities like London, where many lived "forty to a house, ankle deep in sewage, working sixteen-hour days in unspeakable conditions, and dropping like flies from malnutrition. No one knew what to do with them, there had never been that many people living that close together before, an epidemic might tip the scales toward anarchy."[2]

In mid-October 1831, a sailor in the port of Sunderland, William Sproat, collapsed. His symptoms were violent pains, diarrhea, vomiting, high fever, and massive loss of body fluids. Three days later, he was dead. Sproat was the first British cholera victim. Within a month, cholera was in London and the death toll was rising. No one knew what caused it or how to stop it. In 1836, William Farr entered the story as the Compiler of Abstracts for the General Register office. In some form or other, all the historians reviewed for this analysis except three make mention of Farr and his compiling and use of statistics. John M. Eyler, in *Victorian Social Medicine: The Ideas and Methods of William Farr*, authored the most extensive look at Farr's work. The book touched on a number of Farr's theories regarding mortality and the spread of epidemic disease. The most important of these had to do with urban overcrowding and its relation to public health. The next book to discuss Farr's work in detail, authored by Margaret Pelling, *Cholera, Fever and English Medicine, 1825-65*, paints Farr in the light of a scientist looking for answers, and sometimes using conflicting theories for they often produced useful results.[3]

Perhaps James Burke put the clearest explanation of Farr's use of statistics forth in both his television series and book entitled *The Day the Universe Changed*. In his book, Burke detailed Farr's use of life-tables. Farr's life-tables "listed data in seven

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[2] James Burke "What the Doctor Ordered," *The Day the Universe Changed,* http://clickcaster.com/item/view/what-the-doctor-ordered-social-impacts-of-new-medical-knowledge (accessed April 3, 2007)

[3] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 109.

categories: years of life, number reaching that age, number dead at that age, and the various conclusions to be drawn from the previous three sets of figures, such as rate of death and expectancy of life at all ages". Farr placed these figures alongside of those from a healthy community. Farr's definition of a healthy community was one in which "seventeen deaths occurred per thousand people, more than that would indicate death due to preventable causes." Burke went on to explain Farr's land elevation theory, which in essence, was that the further away from the Thames people lived, the fewer less cholera deaths there were. That is, there was a relationship between cholera incidence and height above the Thames. The higher the elevations, the lower the incidences of cholera. Being a sanitationist and miasmatist, Farr wondered what was lethal in the stench from the Thames.[4] In the television series, Burke gave an abbreviated explanation of the above while sitting in front of a circa 1980s IBM computer calling up graphs and maps as he explained, "Cholera deaths followed the contour lines exactly;" the highest death rates occurred on the river and decreased as the elevation above the river increased.[5]

Arthur Newsholme, in "The Measurement of Progress in Public Health with Special Reference to the Life and Work of William Farr," also described the land elevation theory, his burning desire for social service, and his statistical skill. The author described Farr's statistical skill as being as high as his desire for social service. "Farr's burning desire for social service was as marked as his statistical acumen…."[6] This statement suggests Farr possessed a high level of mathematical skill. However, Margaret Pelling described Farr's mathematical skill as fairly limited:

> There is no evidence of his ever having been formally instructed in

[4] James Burke, *The Day the Universe Changed*, (Boston: Little, Brown, 1985), 229.
[5] James Burke "What the Doctor Ordered," *The Day the Universe Changed,* http://clickcaster.com/item/view/what-the-doctor-ordered-social-impacts-of-new-medical-knowledge (accessed April 3, 2007)
[6] Arthur Newsholme, "The Measurement of Progress in Public Health with Special Reference to the Life and Work of William Farr," *Economica* 9 (1923):190.

> mathematics; undoubtedly, his fairly limited skills were initially acquired as tools to serve his other concerns.[7]

This disparity was confusing; of the authors that discussed Farr's use of statistics, Pelling was the only one to state Farr's mathematical ability as limited. The rest of her chapter on Farr was positive, describing him as conventionally scientific, making an explicit distinction between theory and practice. Pelling further described Farr as maintaining that both speculation and analytical reasoning were useful; and "that in sanitary practice no single measure… was more important than any other, and that housing and education were perhaps the most important of all."[8] Those are just a few examples of her positive view.

Both John M. Eyler in "The Changing Assessment of John Snow's and William Farr's Cholera Studies" and James Burke gave the impression that Farr had a high level of mathematical skill. As stated above, Farr's compiling of the life-tables and drawing conclusions from the data must have taken a high level of mathematical skill and analytical reasoning ability. By analyzing statistics, Farr linked cholera with the Thames and water in general and even if it was by the miasma theory, the connection was made. Additionally, Farr's contemporaries were impressed with his life-tables. They "welcomed each statistical return as an infallible addition to factual knowledge."[9] This statement was supported by Eyler, who stated, "Farr was the recognized authority on vital statistics and epidemiology and the one whose report on the 1848-49 cholera epidemic was considered authoritative."[10] It is difficult to conclude that Farr had limited mathematical skill in the light of the authors referred to above and Pelling's own statements on Farr in

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[7] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 85.

[8] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 84

[9] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 83

[10] John M. Eyler, "The Changing Assessment of John Snow's and William Farr's Cholera Studies," *Soz Praventiv Med*; 46.4 (2001): 225.

the chapter of her book.

At about the same time, in another part of the medical forest, John Snow was formulating his theory of cholera as a waterborne agent that had to be ingested to do harm.[11] The waterborne theory did not gain ready acceptance in the medical community at the time. Now, Snow's conclusion seems obvious, but in the late 1840s and early 1850s, his conclusion was not obvious, not even to William Farr. However, to his credit, Farr included the full set of precautions urged by John Snow in his first report on cholera published in 1852.[12] According to Pelling, "Snow was criticized not because he held certain views, but because he held them to the exclusion of all others."[13] The problem was not enough evidence for the medical establishment. What they were looking for, according to P. E. Brown, was the crucial evidence that water was an agent of cholera. [14] In London, at the time, too many other variables could not be dismissed, even given the evidence of the Broad Street pump.

In mid-1854, people near the vicinity of number 40 Broad Street were dying of cholera. John Snow investigated with some help from a local priest, and found the connecting factor in all the deaths in the area was the drinking of water from the Broad Street pump. The most significant finding, after Snow had mapped out the area around the pump, was that everyone inside the border he had drawn lived closer to the pump and everyone outside the border had some reason to draw water from it. Snow's investigation was made possible by William Farr's statistical work.[15]

The next pieces of evidence Snow gathered were the case of an elderly widow who died in Hampstead and the case of the Lambeth water company. The case of the

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[11] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006), 120.

[12] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 109.

[13] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 205.

[14] P. E. Brown, "John Snow—The Autumn Loiterer," *Bulletin of the History of Medicine* 35 (1961):525.

[15] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006), 140-141.

elderly widow who along with her niece or daughter, historians were unclear on the point, drank water delivered to them from the Broad Street pump; they both contracted cholera and died. According to Deborah Cadbury, in *Dreams of Iron and Steel*, Snow added this case to his evidence and brought it before the Board of Guardians of St. James' Parish and the pump handle was removed the next day.[16] In her book, Cadbury devoted one chapter to the London sewers in which she discussed both Snow and Farr.

Steven Johnson, in *The Ghost Map*, described the Board members as being skeptical, yet Snow's argument was persuasive. If Snow were wrong, people would go thirsty for a few weeks. If he was right, lives could be saved. So the Board voted to remove the pump handle.[17] Cadbury conveyed the impression that the Board members simply accepted Snow's argument. While, Johnson explained their deliberations and that they believed miasma was more likely responsible for the outbreak of cholera than the Broad Street pump. It was clearer from Johnson than Cadbury that the Board was acting on the little information it had available.

In the case of the Lambeth water company, Snow found Lambeth was the only water company obeying a new law that required water companies to take their water supply from further upstream, and it supplied an area of London street for street with a company that did not obey the law, thus supplying contaminated water. He also found that before the law was passed both Lambeth and its competitor took their water supply from the same area and neither company in 1849 nor 1854 filtered or treated their water. According to Eyler, "the circumstances seemed to be an ideal natural experiment…." By comparing the mortality rates of each set of patrons in 1854 and 1849, Snow concluded that cholera mortality was fourteen times higher among those served contaminated

[16] Deborah Cadbury, *Dreams of Iron and Steel: Seven Wonders of the Nineteenth Century, from the building of the London Sewers to the Panama Canal,* (New York: Fourth Estate, 2004), 130.

[17] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006), 160.

water. During the epidemic, the gap narrowed, but patrons of Lambeth's competitor were still between eight and nine times as likely to die from cholera.[18] The above is a paraphrased explanation taken from Eyler's article. Johnson gave a clearer explanation; not a single person of the 14,632 Lambeth patrons died of cholera.[19]

Cadbury's view of what happened next was clear, if somewhat inaccurate. She stated that Snow's theory was rejected, and William Farr was his chief opponent.[20] While it was true that the General Board of Health rejected Snow's conclusions, it is not clear that Farr was his chief opponent. Eyler stated an opposing view, "no one took Snow's work more seriously than Farr."[21] Johnson supported that by stating, "Farr was the closest thing Snow had to an ally in the medical establishment. Farr was not entirely opposed to Snow's theory…." He was intrigued enough by it to add a new category to his statistics. Farr tracked where people got their water.[22] Additionally, Pelling stated it was difficult to decide what Farr's role was in the judgment against Snow. Snow found him very helpful. Farr was careful to note the influence of different water supplies, and stated of Snow's theory that it was "in many respects the most important theory that has yet been propounded."[23]

Cadbury conveyed the impression that Snow's conclusions were rejected out of hand. However, as stated above, Farr did not appear to be Snow's chief critic. Additionally, Snow was criticized for the exclusiveness of his views. Cadbury did not explain that there were defects in Snow's evidence. According to Eyler, Snow began with

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[18] John M. Eyler, "The Changing Assessment of John Snow's and William Farr's Cholera Studies," *Soz Praventiv Med*; 46.4 (2001): 226.

[19] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006), 107.

[20] Deborah Cadbury, *Dreams of Iron and Steel: Seven Wonders of the Nineteenth Century, from the building of the London Sewers to the Panama Canal,* (New York: Fourth Estate, 2004), 131.

[21] John M. Eyler, "The Changing Assessment of John Snow's and William Farr's Cholera Studies," *Soz Praventiv Med*; 46.4 (2001): 227.

[22] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006). 102.

[23] Margaret Pelling *Cholera, Fever and English Medicine*, *1825-65*, (Oxford: Oxford University Press, 1978.), 228-229.

his theory and worked to find evidence in favor of it. He overlooked negative evidence and seemed to ignore what the profession had learned about cholera. Pelling pointed to Farr seeing clearly the flaws in Snow's evidence, and Farr apparently suggested a wider investigation into the influence of London's water supply. The clear inference is that Snow's work was outside the mainstream, and the medical establishment needed more evidence.

Cadbury and Johnson both viewed Snow as an investigator working against the narrow vision of the medical establishment. The difference between them is Cadbury saw Farr as Snow's chief opponent who after ten years finally saw the value of Snow's waterborne theory. While Johnson saw Snow and Farr as allies in the battle against cholera, each assisting the other. How Cadbury could have overlooked the sources cited here that were published before her book is unknown. It is clear that with just a few well-placed sentences, she could have provided a more accurate view of Farr and his opinion of Snow's work. As it was, the chapter provided a one-sided, inaccurate view of the work of both men.

In contrast, Johnson provided a more balanced view of the work of both Snow and Farr. While Johnson clearly favors Snow and paints him as a pioneer being rejected by the medical establishment, he does not imply Farr was close-minded. In fact, Johnson clearly illustrated that without Farr's work, Snow could not have reached his conclusions. However, Johnson took the Board of Health Committee of Scientific Inquiry to task for rejecting Snow's conclusions while other committees accepted them. He characterized the committee's rejection as one based on confirmation bias. That is, "the tendency to force new information to fit one's preconceptions about the world." He described the men on the committee as reasonable professionals blinded by the miasma theory.[24] That seems true in hindsight, but Johnson's characterization placed the problem outside the

[24] Steven Johnson, *The Ghost Map* (New York: Riverhead Books 2006). 182-186.

context of the time. The use of modern psychology to describe nineteenth-century behavior precluded an analysis of cholera from the perspective of the people who dealt with it.

As stated above, according to Eyler, Snow began with his theory and worked to find evidence in favor of it. He overlooked negative evidence and seemed to ignore what the profession had learned about cholera.[25] Judged by Johnson's characterization, Snow's exclusiveness would seem to be confirmation bias. Thus, the Board and Snow engaged in the same activity; the only difference was their points of view. Farr seemed to be more inclusive than both Snow and the medical establishment. As stated above, Farr was inclusive of conflicting theories because they sometimes produced useful results. By 1866, Farr was one of the few champions of the waterborne theory.

The historians that did not focus on Farr's statistical work either mention him in passing in relation to John Snow or paint him as one of Snow's chief opponents. Charles E. Rosenberg in his article "Cholera in Nineteenth-Century Europe: A Tool for Social and Economic Analysis" provided the best example of a passing reference to Farr. He reduced Farr to a footnote, stating that he came to similar conclusions at almost the same time as Snow, and "for the sake of convenience," Rosenberg referred to the new ideas as Snow's.[26] While Rosenberg's article focused on cholera as a tool for social and economic analysis, and he did not discuss all of John Snow's work, by relegating Farr to a footnote, literally, Rosenberg conveyed the impression that Farr was just another pioneer in Snow's field. In the same footnote, Rosenberg listed sources for further information on Snow's work, but nothing was listed for William Farr.

Another author that mentioned Farr in passing was P. E. Brown. In "John Snow–

[25] John M. Eyler, "The Changing Assessment of John Snow's and William Farr's Cholera Studies," *Soz Praventiv Med*; 46.4 (2001): 227

[26] Charles E. Rosenberg, "Cholera in Nineteenth-Century Europe: A Tool for Social and Economic Analysis," *Comparative Studies in Society and History* 8.4 (1966): 459.

The Autumn Loiterer," Brown gave Farr one sentence in which he stated that Farr, along with someone else, expressed concern "over the discovery of urine in the wells of Glasgow."[27] Brown's focus was on Snow, and he may have assumed his audience had prior knowledge of Farr's work. Brown did not gloss over the flaws in Snow's procedure. He stated:

> Whichever way we look at it, we are forced to conclude that Snow had hit on an idea, which he had not the means nor the abilities to put to the test. The first of his difficulties came from the fact that his original inspiration was the result of a haphazard process of reasoning which no later rationalization could ever turn into a convincing argument.[28]

Both Pelling and Eyler, but not Johnson or Cadbury, sourced Brown's article. That seems to suggest Johnson and Cadbury overlooked sources that did not support their point of view.

The authors that focused on Farr treated Snow well. Eyler, in *Victorian Social Medicine: the Ideas and Methods of William Farr,* stated that Snow's theory put the issue of water purity into the discussions of cholera.[29] Additionally, Newsholme suggested that Farr's land elevation theory was "probably influenced by Snow's important work."[30] Interestingly, James Burke did not mention Snow in his television program, but did mention Snow in his book. In the television program, Burke referred to someone discovering that a cesspool was leaking into a well.[31] Then, he went on to describe the case of the Lambeth water company; Burke gave Farr credit for the comparison between

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[27] P. E. Brown, "John Snow—The Autumn Loiterer," *Bulletin of the History of Medicine* 35 (1961):524.

[28] Ibid 527.

[29] John M. Eyler, *Victorian Social Medicine: the Ideas and Methods of William Farr* (Baltimore: Johns Hopkins University Press, 1979), 117.

[30] Arthur Newsholme, "The Measurement of Progress in Public Health with Special Reference to the Life and Work of William Farr," *Economica* 9 (1923)

[31] James Burke "What the Doctor Ordered," *The Day the Universe Changed,* http://clickcaster.com/item/view/what-the-doctor-ordered-social-impacts-of-new-medical-knowledge (accessed April 3, 2007).

the two water companies and the conclusion that was drawn from it. In his book, Burke did refer to Snow and the Broad Street pump, and to Snow's theory. However, in the case of the Lambeth water company, Burke gave credit to John Simon.[32]

The disparity between his television program and the chapter of Burke's book was interesting. It suggests that given the limited time of a television program and the limited space in a book chapter, a full discussion of Snow's work would have been inappropriate given the focus of both the program and the chapter. The focus of the program and the chapter was the use of statistics in medicine and public health. Thus, Burke focused on Farr. It is unclear why he introduced John Simon into the case of the Lambeth water company. It is possible that Simon carried out the further investigation into London's water supply that Farr had suggested.

The authors focusing on Snow were either too critical of his work like, Brown, or too forgiving, like Cadbury. Others such as Johnson, Eyler, and Pelling, dealing with both Snow and Farr, presented a more balanced perspective of their work. It is clear Cadbury overlooked sources that did not support her point of view, and inaccurately portrayed Farr and his work. Johnson, on the other hand, while presenting a balanced view of both men's work, analyzed the medical establishment in hindsight, thus distorting the true nature of their difficulty in accepting Snow's theory. Eyler and Pelling presented the most balanced view of Snow's and Farr's work and their importance in the battle against cholera.

Although historians have different points of view on the work of Snow and Farr, the work of both men was crucial in the battle against cholera. It is necessary to see the connection between them to understand the battle against cholera as a whole. No one historian or historical philosophy is sufficient to formulate a complete understanding of

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[32] James Burke, *The Day the Universe Changed*, (Boston: Little, Brown, 1985), 233.

the conflict.

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