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Salmonella Infections, Networks of Knowledge and Public Health in Britain, 1880-1975

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Between school and university I worked for a year as a lab technician in Dulwich Hospital in south London. After some months, I had developed sufficient expertise to be asked to make extra blood tests on a patient whose illness had proved impossible to diagnose. At that time, the mid-1960s, analyses were done in test tubes and flasks, on dilutions of serum handled without gloves and sampled using mouth pipettes! I completed the tests, passed on the results and thought nothing more about it. A week later a senior consultant came to lab and informed us that the patient had finally been diagnosed. Worryingly, it was with typhoid fever, an infection caused by *Salmonella typhi*.(1) Everyone one in the lab was placed under surveillance for three weeks. I felt uniquely vulnerable having undertaken the extra tests and worried myself sick; literally so on occasions and this further added to my anxiety. Typhoid fever was greatly feared at the time, as the most serious form of food poisoning, though one expected to catch it from eating contaminated Argentinian corned beef, as in the Aberdeen outbreak in 1964, not at work. My first two tests were negative. However, at five o'clock in the morning on the day my final result was due, I was awoken by a blue light strobing round my bedroom ceiling. I went to the window and there was an ambulance outside our house with its rear doors open. I waited for the knock on the door, expecting to be taken to isolation. But was soon reprieved when ambulance men emerged from the house opposite with a neighbour who, in turned out, had gone into premature labour. Later that day I learned that my final test result was also negative. For while I was more careful with pipetting and washing my hands, but soon returned, like everyone in the labs, to handle blood and other body fluids in casual ways that would be in breach of every current health and safety standard.

Anne Hardy, in her fine study of food poisoning in Britain from 1880 to 1875, demonstrates that infections due to the *Salmonella* bacillus were typically viewed as ambivalently as they were at Dulwich Hospital in the winter of 1966. On the one hand, outbreaks were the subject of concerted scientific investigation and public health concern, which raised popular fears, particularly during episodes with high mortality. Yet on the other hand, such anxieties did not persist and alter behaviour in the longer term, leading to constant complaints by public health authorities about the nation's poor domestic hygiene and British government complacency in the face of dangers from new ways of producing, distributing and consuming food. Indeed, in her conclusion, Hardy argues that the situation did not alter until the quarter century after her study ends, when serious food poisoning outbreaks, as at Stanley Royd Hospital in Wakefield in 1984 and then with the

BSE (bovine spongiform encephalopathy) crisis in the 1990s, led to radical changes in public health policy and popular attitudes.

Few textbooks on Victorian social history fail to mention of the practice of food adulteration, with students learning about chalk in white bread and iron filings in tea. They then learn how reformers introduced legislation to protect the public from fraud and poisoning, drawing upon the new expertise of chemical analysts. One general theme of Hardy's narrative is the contrast between the active responses to the chemical adulteration of food in the 19th century, with the decidedly uneven reactions to microbiological contamination in the 20th century. It is particularly ironic then that the term 'food poisoning', coined in the Victorian era when chemical poisoning haunted the popular imagination (2), came in the 20th century to be wholly associated with illnesses caused by microbes. Its first new usage was in the Welbeck typhoid fever outbreak in 1880, with which Anne Hardy begins chapter four.

The incidence of typhoid fever declined through the Victorian era; none the less it continued to have a formidable reputation. It had after all caused the death of Prince Albert in 1861 and nearly seen off his son the Prince of Wales a decade later. Although mostly a disease of the poor, the high and mighty were also vulnerable. Outbreaks were sporadic and sources hard to track down, even when public health doctors accepted it was caused by a specific bacillus and knew that it was transmitted in contaminated water or food. One reason, discovered in the first decade of the 20th century, was the asymptomatic carrier – a person with no illness, who harboured the bacillus in their gut and was able to spread infection almost indefinitely. Hardy's discussion of the variability and complexity of typhoid fever outbreaks in Britain around the turn of the 20th century is an invaluable addition to the history and historiography of the disease, which has been dominated by the quite atypical story of 'Typhoid Mary' in the United States. Mary Mallon worked in catering and was a carrier for decades, causing so much infection over many years that she was incarcerated for public safety from 1915 until her death in 1938.(3)

Typhoid fever, caused by *Salmonella typhi*, moves into the background after chapter one, and the remainder of the book is about the generally less severe disease caused by varieties of *Salmonella enteriditis* – the principal cause of food poisoning in Britain until the 1970s. The challenge that Hardy has taken on, and very successfully realised, is to weave the history of the different ways that Salmonella bacteria were seen, classified and controlled by scientists and public health officials, with their changing epidemiology and their social impact. A very important achievement, which Hardy barely acknowledges, is that she has written a history of a disease whose main impact was on morbidity rather than mortality. This is a considerable novelty. The history of medicine in general, and the genre of the history of infections in particular, are skewed towards killer diseases and epidemic crises. Historians have largely ignored the typical experience, then and now, of infectious diseases – illnesses of varying lengths and severity, which are self-limiting or respond to treatment, and from which the great majority of people recover. Today, the overall mortality rate from non-typhoidal Salmonella infection in first world countries is around one death in 2,500 cases (0.4 per cent), though it can be much, much higher in the elderly or in other vulnerable groups. The WHO estimates the mortality rate globally at between 1.5 and 3.8 per cent, which is likely to have been the rate in late 19th-century Britain.

The first four chapters are grouped under the heading ‘Pathways of infection’ and after the discussion of typhoid fever and its spread by ‘Human animals’, the other three chapters cover infection from shellfish, from flies and birds; and from ‘other animals’, principally meat, milk and vermin. In discussing food poisoning from mussels, oysters, winkles, shrimps and whelks in chapter two, Hardy provides fascinating insights into a popular early 20th-century ‘fast food’, alongside details of the growing, but contested, impact of bacteriological laboratory testing. The mid-Victorian fear of airborne miasmas, had, by the late 19th century, changed to a focus on specific microbes, their identifiable routes of transmission and particular portals of entry to the body. Chapter three shows that the aerial threat turned to microbe-carrying flies, especially as spreaders of infant diarrhoea. Whether flies were major factors in the spread of food poisoning was never proved, but public health officials felt that campaigns against such visible vectors would hopefully educate the public of the need for hygienic practices.

Anxieties about Salmonella infections from poultry and eggs predated Edwina Currie’s infamous 1988 statement that ‘Most of the egg production in this country, sadly, is now affected with salmonella’. In the 1920s and 1930s, duck eggs and bulk imported liquid eggs from China were shown to be the cause of isolated outbreaks. However, it was American spray-dried eggs, imported during the Second World War to meet food shortages, that increased the scale of potential food poisoning from poultry. It also signalled the beginning of new sources of danger from industrialised food production, processing and distribution. Bacterial food poisoning from meat and milk, the themes of chapter four, had first come to the attention of public health agencies in the 1880s. Outbreaks were typically traced to raw, cooked, cured and pie meats, with contamination in abattoirs a particular concern. On this front, Hardy shows that the move from slaughtering in local butchers to better regulated, larger facilities (often council-run) significantly improved public safety. Until the 1930s, milk hygiene had focused on the high profile problem of tuberculosis; none the less, raw milk was still widely distributed and consumed. The answer to both tuberculosis infection and Salmonella poisoning was Pasteurisation, though this was resisted by many groups as turning a natural product into a manufactured one and reducing its nutritional value. Also, in an era when the public were complacent, homes were crowded and domestic refrigerators the preserve of the wealthy, domestic contamination continued to be a danger.

Part two of the book deals with ‘Laboratory pursuits’: first, with a chapter on the linking of epidemiological and bacteriological understandings of Salmonella, and then one on the place of British scientists in international bacteriological networks. Chapter five begins with an extremely valuable account of public health bacteriological laboratories in Britain in the late 19th and early 20th century. This survey counters the familiar story of the dearth of provision, yet shows that geographical coverage was uneven and the use of the laboratories quite irregular. The great breakthrough in the epidemiology of Salmonella infections came from the laboratory and was the recognition of number of different types of *Salmonella enteriditis*. Contemporaries were surprised that there were soon ten or twenty; they would no doubt be shocked to learn that today over 2,500 have been identified. How types were found and named was complex, but I felt that Hardy could have set out more clearly at this point the two methods that became standard – serotyping and phage typing. Serotyping used methods developed at the very end of the 19th century, making use of the manner in which the human immune system responded to bacteria. The serum of people infected shows a highly specific reactivity to the type of the infecting bacillus and such serum can be subsequently used to identify the same microbe in other sufferers. Phage typing arrived in the inter-war period, using the fact that bacteria are themselves susceptible to infection by viruses called bacteriophages, typically shortened to phages. These infections are also highly specific and offered a further, usually secondary, level of differentiation. To have included these points earlier in the book would have better prepared readers for later chapters, especially the excellent chapter seven, but that said, Hardy provides a detailed and engaging account of the impact of the laboratory on policy. She shows how the laboratory became central in the investigation and control of outbreaks, creating new types of epidemiological enquiry and new responses to food poisoning outbreaks.

Chapter six discusses the circulation of knowledge and technique amongst a growing international network

of laboratory scientists. Hardy adopts a transnational frame to chart both the collaborative and contested activities of groups in Britain, at the Lister Institute for Preventive Medicine, in Germany, at the Robert Koch Institute, and laboratories in France, Denmark, and the United States. One contest was over taxonomy: was the best way to classify the Salmonella with serological (the Lister group) or biochemical (the Koch group) methods? There were attempts at rapprochement through the Health Committee of the League of Nations, and various scientific meetings, including an International Committee on Nomenclature of Salmonella Subcommittee. The Lister group, backed by the influential Fritz Kaufmann in Copenhagen, formed an alliance that gained hegemony for serological methods, but after 1945 the United States' Centers of Disease Control (CDC) came to the fore.(4) Hardy shows how personalities, groups, networks and institutional politics interacted in complex ways to shape the changing ways of knowing and working on Salmonella. I would have been interested to have seen an exploration of an approach pioneered in animal studies, namely, a consideration of the agency of the microbes themselves; for example, how their variable biology made closure on any system of classification problematic.

For me, chapter seven was the highlight of the book. Hardy insightfully combines bacteriological, disease and socio-cultural histories. The eventual consensus amongst bacteriologists to name Salmonella serotypes after the location of their first identification, allows Hardy to 'reveal the [food poisoning] experience of England (and Wales) as a story of changing disease ecologies, of a [previously] relatively stable bacteriological environment under siege from alien invaders, and of bacteria that, in the course of a few decades, took on a global future' (p.158). The Second World War was a turning point, with unprecedented movements of people and foodstuffs, and new technologies of food production and distribution. Yet old imperial wars had their legacy. An outbreak of typhoid fever in Cornwall in the lead up to the D-Day landings, was traced to a carrier, who had a type first identified in South Africa in the Boer War 43 years earlier! Between 1941, when American spray-dried eggs were first used, and the end of the war, the number of food poisoning outbreaks in Britain increased markedly, as did the varieties of types causing them. Serotypes never seen before in Britain were identified: *Salmonella oranienburg* (South Africa), *montevideo*, *tennessee*, *bareilly* (India). Previously, the main British serotypes were local: *S. newport*, *dublin*, *derby*, *eastbourne*, *stanley*, *london* and *aberdeen*. Imported egg products remained an important source of outbreaks until the mid-1960s, when shellfish (prawns from Japan and shrimps from China) and dried coconut (from Sri Lanka) added to the native flora. In the 1950s, protein-rich fishmeal from Angola was fed to livestock to boost weight gain, but some batches carried Salmonella, which infected livestock, causing losses to farmers and another source of risk to consumers.

The third and final section of the book is on 'Sites of infection', with chapters respectively on the farm and the home. Chapter 8 shows how further changes in farming, notably intensive, large-scale calf and poultry rearing, created new opportunities for Salmonella to flourish and spread. However, making farms, abattoirs, handling plants and distribution Salmonella-free was, even if technically possible, economically prohibitive; hence, the job of reducing the risk of food poisoning remained the home kitchen – the subject of the chapter nine. The Second World War saw the proliferation of works' canteens and other sites of mass catering, such as schools, hospitals and other welfare institutions. New standards of hygiene were introduced, but were not always adhered to, especially with pre-cooked and re-heated meats. Public health officials complained regularly of public indifference to food hygiene standards, particularly in the home, where there was ever greater reliance on prepared foods and chilled products, but continued laxity with food hygiene.

Hardy's narrative ends in the mid-1970s and her conclusion begins with a brief, yet revealing account of changes in the ecology of food poisoning since then. Salmonella has declined in relative importance, with *Clostridium difficile* and *E. coli* becoming as, if not more, serious problems. At the same time, a growing number of bacterial types have become resistant to antibiotics, thus limiting the options for the treatment of Salmonella food poisoning. Also, the risks are no longer just microbes that affect the gut. BSE was associated with new variant Creutzfeldt –Jakob Disease (*nv*CJD,) a disease of the brain and nervous system that led to inevitable death.

Anne Hardy's *Salmonella Infections, Networks of Knowledge, and Public Health in Britain, 1880-1975* will

deservedly become a standard text for historians of late 19th- and early 20th-century public health in Britain. The narrative reveals the uneven, yet revolutionary impact of bacteriology on epidemiology and public health practice and sets events in Britain in a transnational context. The book is a must too for social historians, as it offers fascinating and novel insights into domestic life, through what food was brought into the home, how it was prepared and eaten, and how, too often, it had unwanted consequences.

Notes

1. I found a record of the case in the Wellcome Library's online collection *London's Pulse: Medical Officer of Health Reports, 1848-1872* < http://wellcomelibrary.org/moh/report/b18239924/31#?asi=0&ai=31> [2] [accessed 2 September 2015].Back to (1)
2. I. Burney, *Poisoning and the Victorian Imagination* (Manchester, 2006).Back to (2)
3. J. Leavitt, *Typhoid Mary: Captive to the Public's Health* (Boston, MA, 1996).Back to (3)
4. A. Homei and M. Worboys, *Fungal Disease in Britain and the United States: Mycoses and Modernity, 1850–2000* (Basingstoke, 2013).Back to (4)
