Snow and Farr: a scientific duet

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John Snow (1813–1858) is an uncommon historical character because, as the mysterious Roman divinity, Janus, he is a two-faced man: Snow the anesthetist and Snow the epidemiologist. Snow the anesthetist was famous, recognised and respected. Queen Victoria even accepted to be among the first women to whom he administered chloroform. How much confidence does it require for a queen to serve as the guinea pig of a new therapy? In contrast, it took a century for Snow the epidemiologist to become praised for having demonstrated better than anyone before him that cholera was caused by micro-organisms communicated from persons to persons by polluted water or food. The paradox is that today Snow is probably more widely known for his pioneering work in the epidemiology of cholera than for being one of the founders of anesthesiology.

In our series of papers on the history of epidemiology we publish two contributions on this paradoxical fate of Snow. The articles by Eyler [1] and Vandenbroucke [2] help us understand why the epidemiologic work of Snow was ignored during his lifetime but became later a classic reference of modern epidemiology, described in 1936 by Wade Hampton Frost (1880–1938), the first Professor of Epidemiology of the Johns Hopkins School of Hygiene and Public Health, as "a nearly perfect model". Eyler [1] reviews the situation during Snow's lifetime and Vandenbroucke [2] analyses the historical evolution of Snow's impact.

When considering this historical episode, it is important to bare in mind the public health achievements of the society in which Snow lived, and in particular the work of William Farr (1807–1883). As Superintendent of the General Register Office, England's center for vital statistics, Farr had created a unique and innovative system of standardised procedures for collection, classification, analysis, and report of causes of deaths. For instance, Farr's administration generated a three hundred page report on the 1848–49 epidemic of cholera, a Herculean collective work given that there were no machines to treat automatically all the information. Farr attempted to trace the cholera epidemic over time and space and investigated the roles of sex, age, seasons, day of the week and soil elevation. This material led him to propose a "law" that could predict in mathematical terms human mortality from cholera according to soil elevation. Farr's law did not reflect causation, and more generally his theory that diseases were caused by zymotic (that is, produced by fermentation) factors was wrong. But his activity laid the ground to what we call today surveillance of disease [3].

Snow would not have been able to perform his epidemiologic investigations without the background of Farr's activity. As well known, Snow's brilliant ideas was to recognise the conditions of a natural experiment created when one water-supply company of London, the Lambeth Company – but not the Southwark and Vauxhall Company – moved its water inlet to a less polluted area of the Thames. Snow's hypothesis was that if cholera was related to consumption of water contaminated by human excrements, then mortality rates should be greater among those who drank the contaminated water supplied by the Southwark and Vauxhall Company than among those who drank the cleaner water supplied by the Lambeth Company. Snow wrote that, in 1853, it was Farr who first noted the potential importance of the arrangement of water supply in South London:

"London was without cholera from the latter part of 1849 to August 1853. During this interval an important change had taken place in the water supply of several of the south districts of London. The Lambeth Company removed their water works, in 1852, from opposite Hungerford Market to Thames Ditton; thus obtaining a supply of water quite free from the sewage of London. The districts supplied by the Lambeth Company are, however, also supplied, to a certain extent, by the Southwark and Vauxhall Company, the pipes

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of both companies going down every street, in the places where the supply is mixed, as was previously stated. In consequence of this intermixing of the water supply, the effect of the alteration made by the Lambeth Company on the progress of cholera was not so evident, to a cursory observer, as it would otherwise have been. It attracted the attention, however, of the Registrar-General, who published a table in the "Weekly Return of Births and Deaths" for 26th November 1853 (…)" [4].

Snow later obtained from the Registrar General Office the addresses of persons dying of cholera. The following year, during the epidemic of 1854, Snow carried his own investigations and communicated to Farr his first results about the relation between cholera deaths and source of water supply. Snow writes that "Dr Farr was much struck with the result and, at his suggestion, the Registrars of all the south districts of London were requested to make a return of the water supply of the house in which the attack took place, in all cases of death from cholera" [4].

The discovery of the mode of transmission of cholera appears therefore as a successful synergy between Snow and Farr, medicine and public health. Snow, not being perturbed by the belief in a wrong (miasmatic) theory of disease causation, was able to read correctly what the statistics said and reached the right conclusion about the waterborne origin of cholera earlier than Farr. But he did not convince his contemporary fellows of the scientific establishment. On the other hand, Farr came to agree with Snow's conclusions about twelve years after the 1854 epidemic. Some of Farr's writings reflecting the miasmatic theory sound very archaic today. In his Tenth Annual Report of 1847, Farr talks of "the disease mist, arising from the breath of two millions of people, from open sewers and cesspools, graves and slaughter-houses (that) … like an angel of death has hovered for centuries over London" (see [5]*). But Farr's surveillance system was a strong foundation to build a theory. It had provided Snow with the statistics he needed and it finally converted Farr himself to the waterborne theory, years before Koch identified the cholera bacillus (in 1884). The terms in which The Lancet of August 15th, 1868 commented Farr's acceptation of Snow's hypothesis indicate that it was not only the conclusion but also the means by which Farr had reached his conclusion that counted : "the elaborate array of facts which Dr Farr has set forth with so much skill, as the result of great labor and research, will render irresistible the conclusions at which he has arrived in regard to the influence of the water supply in the causation of the epidemic." (quoted by Halliday* [5]*).*

Snow reached his conclusion by bright intellectual leaps, while Farr built his argument using a more formal methodological approach, encompassing data collection, standardisation, and analysis [6]*. Over the years, a "learned scientific discussion", as Jan Vandenbroucke puts it, took place between Snow and Farr. Farr helped Snow but rejected his conclusions. Snow asked help from Farr but rebutted Farr's hypothesis that mortality from cholera was lower in London districts that were more elevated above the polluted Thames, allegedly because they were less likely to be reached by the miasmatic exhalations* [7] *(p. 96–97).*

In short, the discovery of the mode of transmission of cholera resulted from the convergence of the work of both Snow and Farr. Snow had the correct hypothesis, but Farr had built the most advanced public health surveillance system of that time. This system was instrumental in providing the evidence that convinced the public. In this perspective, and even though they did not work very closely, Snow and Farr appear to belong to the category that François Jacod has called "scientific duet" [8]*, such as Watson and Crick, Jacob and Monod, or, closer to us, Kaplan and Meier, Mantel and Haenszel, Doll and Hill, Susser and Stein, Doll and Peto, and others. None of these duets are alike, but they all performed with brio.*

References

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