

Florence NIGHTINGALE

b. 12 May 1820 - d. 13 August 1910

Summary. Nightingale - a "Passionate Statistician" rather than "Lady with the Lamp" - was driven by the scandalous legacy of the Crimean War to use statistical weapons in her fight for hospital reform.

To most of her contemporaries, as to later generations, Florence Nightingale (FN for short) was the "Lady with the Lamp". However, it was not her lamp but her pen, combined with administrative skill and political influence, that FN wielded so effectively – both in the Crimean War and in her later battles with officialdom, in the cause of army hospital reform and other sanitary concerns. In this work, she wholeheartedly embraced, as a weapon, the new tool of statistics that became available in the nineteenth century – and with such conviction as to be labelled the "Passionate Statistician".

In her 'teens, FN had demanded tuition in mathematics, which she followed with much self-education. Her interest in statistics stemmed from an intense concern with public health and hospitals, manifested well before her first appointment.

Her work in the Crimea does not need retelling. Back in England in 1856, she rejected the role of heroine for that of a practical-minded empiricist, determined to exploit facts and figures in her various campaigns. In this, FN relied heavily on the advice of leading statisticians, especially the registrar-general's officer William Farr.

Her goal was always the winning of the argument – her method was that of overwhelmingly effective communication. In her collaboration with Farr over two decades, her singular contribution was a flair for publicising their statistical findings through the use of diagrams – "to affect thro' the Eyes what we may fail to convey to the brains of the public through their word-proof ears".

In the controversy that followed a Royal Commission on the sanitary scandals of the Crimean War, she invented what are now widely referred to as FN's "coxcombs". The one here reproduced is from her 1858 *Notes on Matters affecting the Health, Efficiency and Hospital Administration of the British Army*.

It shows the progression of the death rates from wounds (red), "preventible disease" (blue) and other causes (black). The legend is careful to explain that "the Areas of the blue, red & black wedges are each measured from

Figure 1: Diagram of the Causes of Mortality in the Army in the East – April 1855 to March 1856

the centre as the common vertex”. Correcting an earlier misleading graphical representation, FN has here made a square-root transformation – by requiring the areas, not the lengths, of the sectors to be proportional to the death rates. In a lecture for the Florence Nightingale Museum, Hugh Small has observed that, in her use of the term “coxcomb”, FN was not referring to such diagrams but, with greater thoughtfulness, to the whole document of which they might form part, such as the colourful attention-getting annex she had earlier attached to the Report of the Royal Commission. If we are to respect FN’s subtlety in this matter, perhaps we should adopt David Spiegelhalter’s description of the diagrams as “polar area charts”.

At times, FN’s concern with the effectiveness of presentation disturbed Farr, who expressed the fear that, in her search for an audience, his colleague sometimes went beyond good statistical method. He even wrote to tell that

We do not want impressions. We want facts . . . Again I must repeat my objections to intermingling Causation with Statistics . . . The statisticians has nothing to do with causation; he is almost certain in the present state of knowledge to err . . . You complain that your report would be dry. The dryer the better. Statistics should be the driest of all reading; what I complain of is that on reading your report I am conscious of receiving a wrong impression, because your details are not sufficiently dry and sufficiently extensive.

FN cannot have been moved much by this appeal. Interest in causes and their uncovering lay at the heart of her activities. Hugh Small’s book is almost a statistical whodunnit, as it documents the story that comes from FN’s revolutionary statistical demonstration, after six months of careful investigation, that the principal cause of the frightful mortality of the Crimean soldiers in her charge was not their poor, half-starved condition on admission, but the filthy state of the hospital itself—a state of affairs hitherto regarded as inevitable in hospitals! Small makes the case that it was FN’s overwhelming sense of statistical guilt—when, alas too late, she uncovered the truth

with William Farr’s help—that triggered the physical collapse that has puzzled her biographers. Fortunately, her interest in the dispassionate analysis of causes revived. Her 1860 International Statistical Congress scheme for uniform hospital statistics was driven by an interest in causes of sickness and mortality. In her 1863 *Notes on Hospitals*, she wrote that the current method of estimating mortality (without reference to age, sex, type of operation or post-operative complications)

“can at best lead to very loose approximations. It can convey but a very imperfect idea of the real state of the case. And one thing is quite certain, that it can lead to no practical result whatever, either as regards the true causes of the mortality, or how these might be mitigated.”

The same command of the statistical highground is evidenced in her 1871 *Introductory Notes on Lying-In Institution* – a publication that led to the saving of many mothers’ lives at childbirth. In 1872, FN sent a copy of this book to the Belgian statistician Quetelet, whom she had met at the 1860 International Statistical Congress. She received in return the two volumes of Quetelet’s 1869 *Physique Sociale* and the companion work *L’Anthropometrie*. Of *Physique Sociale*, she told Farr that she was

astounded at the force of genius and accurate observation which has produced such a work.

This is borne out by many notes that FN made in the margins of *Physique Sociale*, and that are now reproduced in Diamond & Stone (1981). In Quetelet’s work she found expression of the “laws of moral statistics”, which for her became the “very highest kind of religion”. She saw Quetelet as the founder of the most important science in the whole world: for upon it depends the practical application of ... every other Art: the one Science essential to all Political & Social Administration, all Education & Organisation based on experience. For it only gives exact results of our experience.

Her enthusiasm for Quetelet was possible only because Quetelet made his excursions into pure theory a very small part of his writings. Her distaste for theoretical “research” surfaced when she withdrew her offer of £2000 to the research-minded Francis Galton for the endowment of a chair of Applied Statistics at Oxford. There is little to indicate that she understood the statistical theory available to her, or that she cared in the least about it.

Her interests, even when overlaid with a mystical concern with God's laws, were not academic (in the worst sense) but practical, and it is as an advocate of the practical application of statistics that she deserves to be noticed by statisticians today.

However, it is a moot question whether any statistician today, especially one working for some organisation with little or even negative social concern, can take much heart or instruction from FN's example – even though there are many ethical statistical battles to be fought both within and outside such organisations. FN was helped in her statistical work by a “starting capital” that made her unique – family connections, financial independence, and, dwarfing all else, the prodigious public support she acquired during the Crimean War. Nonetheless, FN's involvement with statistics was marked by qualities that were not bought with her starting capital, and that will always repay emulation – qualities of persistence, intellectual passion, and (*pace* the critic F. B. Smith) a manifest inner integrity. She was one who found statistics “more enlivening than a novel” and loved to “bite on a hard fact”. When Farr told her he had a New Year's gift for her “in the shape of Tables”, she replied that she was “exceedingly anxious to see your charming Gift, especially those returns showing the Deaths, Admissions, Diseases”. An eye-witness claimed that, however exhausted Florence might be, the sight of long columns of figures was “perfectly reviving” to her.

Further Reading

- Diamond, M. & Stone, M. (1981). Nightingale on Quetelet. *Journal of the Royal Statistical Society, Series A*, **144**, 66-79, 176-213, 332-351.
- Kopf, E. W. (1916). Florence Nightingale as statistician. *Journal of the American Statistical Association*, **15**, 338-404.
- Small, Hugh (1998). *Florence Nightingale: Avenging Angel*. Constable, London.
- Smith, F. B. (1982). *Florence Nightingale: Reputation and Power*. Croon Helm, London & Canberra.
- Stone, Sir Richard (1998). *Some British Empiricists in the Social Sciences 1650-1900*. Cambridge University Press.
- Spiegelhalter, D. J. (1999). Surgical audit: statistical lessons from Nightingale and Codman. *Journal of the Royal Statistical Society, Series A*, **162**, 45-58.

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