

# Development of clinical probabilistic practice in Britain before Gavarret Part I: the long 18th century

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*This article is in our series on probabilistic thinking and the evaluation of therapies, 1700–1900*

## Theory

As noted in the introductory sketch of this study,<sup>a</sup> there was some (unconscious) probabilistic thinking in British clinics during the 18th century. In this section, I will consider in more detail the motives for, and the modes of, this reasoning, and look further into the 19th century.

It is easily forgotten that the 18th century was a time of innovations in medical and surgical treatments (Tröhler, 2003a, 2006).<sup>1–3</sup> How were they presented? An important precondition for probabilistic thinking gaining ground in medicine, particularly in therapeutics, was – and still is – to step away from confidence in the absolute authority of doctors, whose opinions were too often based on selected, ‘successful’ (single) cases.

Two traditions were combining to build an indispensable basis for probabilistic reasoning during 18th-century Britain, and these had their origins in the 17th century with Bacon, Sydenham and Locke<sup>4</sup>: they were drawing inferences, and even axioms, from carefully registered and sometimes comparative observations; and using numbers to assign symptoms in order to differentiate disease categories and to evaluate interventions.<sup>1,2,5</sup> And there was a growing tendency to report all cases of new treatments observed during a given time period – whether successful or failures, a novelty in itself! Indeed, it has been suggested that this feature of James Lind’s reporting was of more fundamental importance than his controlled trial of treatments for scurvy (Justman, 2017).<sup>6</sup>

## Three modes of probabilistic reasoning by 18th-century clinicians

In other words, there was a transition from (seemingly) certain knowledge to reliance on relative results

based on many observations, successful or otherwise, results that were recognised as partial and evanescent as time went on.

The naval physician James Lind (b.1716) recognised this in 1772 after three decades of service:

A work more perfect and remedies more absolutely certain might perhaps have been expected from an inspection of several thousand... patients. [Certainty was deceitful, he concluded], for though they may for a little, flatter with hopes of greater success, yet more enlarged experience must ever evince the fallacy of positive assertions in the healing art. (Lind, 1772, pp. v–vi).

This and other statements by Lind (Tröhler, 2003b, 2003c) illustrate the unconscious mode of probabilistic reasoning. I found a formulation of a conscious, pre-mathematical mode in the same year by the contemporary British physician, John Gregory, and an application of the conscious, mathematical mode by a clinician of the following generation, John Haygarth.

At the outset of this series I quoted John Gregory (b.1724), a celebrated professor of medicine in Edinburgh, for his explicit use of the term ‘probability’ in 1772.<sup>a</sup> He had also had a mathematical education (and had taught mathematics): In his view, rather than getting stuck in endless argumentations, any

advancement of the sciences and the successful management of business in private life... require[d] only an attention to probabilities, to leading principles, and to [...] a quick discernment where the greatest probability of success lies, and habits of acting in consequence of this, with facility and vigour. (Gregory, 1772/1805, p. 150)

He repeated this argument three more times in his book (pp. 15, 132, 193). And describing the psychological hindrances to doing so he concluded:

It is, indeed, difficult and painful for men to give up favourite opinions, and to sink from a state of security and confidence into one of suspence [sic!] and scepticism... Accordingly, we find that physicians do not easily change the principles they first set out with. (Gregory, 1772/1805, p. 186)

These insights were published in Gregory's *Lectures on the Duties and Qualifications of a Physician* (Gregory, 1772), still often quoted today as the first textbook of medical ethics written in English. They were re-edited in 1805 and in 1817 (in Philadelphia) and translated into French, German, Italian and Spanish. From the 19th century, this book became influential in these cultures for its concept of 'the sympathetic physician'.<sup>7</sup> However, with hindsight, it seems that the passages on probability, linked to the need to acknowledge one's limitations, encountered difficulties in being acted upon with 'facility and vigour'.

As mentioned earlier,<sup>a</sup> new data were needed to show the effectiveness of variolation, this all-embracing innovation in 18th-century medical practice. In turn, this novel concept generated a field of application for the equally novel concept of probability (de la Condamine, 1754; Franklin, 1759; Watson, 1768).

In 1784, John Haygarth (b.1740)<sup>8</sup> of Chester, yet another physician with a mathematical education, wrote in his *Inquiry how to prevent the smallpox*:

It occurred to me that it might be computed arithmetically by the doctrine of chances, according to the data, if one, if two, or if three persons were exposed, for the first time, to the variolous infection, what degree of probability there was that one or more of them would catch the distemper. At my request a mathematical friend made the following computation, on each suppos[it]ion. (Haygarth, 1784, pp. 25–26)

After two lengthy sets of suppositions and calculations, added in small print, Haygarth concluded that 'when three or more persons together, at the same place, at the same time, have all escaped the small pox, [...] they were not exposed to the variolous infection', and he confirmed this in an enquiry with 31 doctors. His 'mathematical friend', Mr. Dawson, 'a truly mathematical genius', had indeed applied a calculus of probabilities (Haygarth, 1784, pp. 25–26).

## Quantification in clinical experience

James Lind, John Gregory and John Haygarth were significant representatives of the 18th-century British movement of 'arithmetic observation': Quantified empirical observations were used to challenge therapeutic dogma<sup>9</sup> and to monitor the introduction of new therapies, both based on what were believed to be 'rational' theories.<sup>1,2</sup> These efforts carried with them the notion of probability of success of a therapy rather than certainty – and a host of new problems. For instance, could averages derived from documenting outcomes in groups be applied to an individual? This question lacked a satisfactory response.<sup>5</sup> And how could comparable data be assembled? As implicit in the variolation story, record keeping was the answer and it was well underway in the 1720s.<sup>3</sup>

Indeed, exact day-to-day record keeping in tabular form was repeatedly propagated and practised in Britain by many doctors throughout the 18th century. The resulting returns, from hospital and military registers and public dispensaries, were discovered as a new source for research (Clifton, 1732; Fordyce, 1793; Haygarth, 1805).<sup>10</sup> Quantification of data derived from them was a new research tool.

## Building up traditions

This 18th-century mental bent was shared by many clinical investigators. They participated in the endeavours and communicated results in an informal network between various cities. It culminated in a textbook by William Black (b.1749), a London dispensary physician, entitled *Arithmetical and medical analysis of the diseases and mortality of the human species* (Black, 1789). Yet, the new numerical approach was also criticised<sup>11</sup>: by 1800, this sketchy probabilistic *Evaluation Science*, this 18th-century 'Evidence-Based Medicine (EBM)' which I have mentioned earlier in this series,<sup>a</sup> had to compete, in research methods, with clinical and pathological observation and description (*Description Science*), laboratory experiments (*Explanation Science*), the study of medical classics (still!), and in practice – as always – with dogmatic routine and fashions.<sup>5</sup>

Clinical arithmetic continued in the early 19th century. In 1819, Sir Gilbert Blane (b.1749), a former naval physician, now a distinguished Fellow of the Royal Society, Gulstonian Lecturer, Baronet (and later *Physician in Ordinary* to two kings), summarised the insights he had gained during his experience in various walks of life. At the age of 70, he published an account of it in his *Elements of medical logick* in terms of a typical British compromise between two

epistemic camps, the rationalists and the empiricists. It was a plea for rational empiricism as we would define it:

[Rationalism and empiricism] ought not to be regarded as adversaries, but as allies, and... good sense will consist in... fairly appreciating which is due to each. This is a compromise. And further: It is only by a sort of arithmetical computation, founded upon large averages, that truth can be ascertained; and hence the danger of founding a general practice on the experience of a single case, or a few cases [be avoided]. (Blane, 1819, pp. 200, 208)

This was unconscious, informal probabilistic thinking at its best as it would henceforth be characteristic of British epistemological literature. In 1823 – Blane’s book was in its third edition – when Thomas Alcock (b.1784), an apprenticed surgeon turned London practitioner and workhouse surgeon, continued the tradition with a 61-page ‘*Essay on the education and duties of the general practitioner... containing suggestions relating to the investigation of disease, and the registration of practical results*’, 1823.

And a decade later, Tweedy J Todd (b.1789) an Edinburgh MD and former naval surgeon, made the tradition explicit, although he entitled his book *The book of analysis or a new (my italics) method of experience...* (Todd, 1831) to encourage physicians and scientists to apply the Baconian experimental method. Both authors propagated various complicated tables for clinical signs and results of different treatments to be compared as ‘*an easier, a surer method*’ for obtaining a better use of experience (Alcock, 1823, pp. 85, 93, 95, 99, 100; Todd, 1831, pp. 86–104, 162–163, 184). Alcock repeated 18th-century positions when writing in 1823 that tables

may be constructed so as to exhibit the general result of all the cases of diseases which have fallen under the student’s observation [...]. The advantages thus obtained, by enabling the student to generalize the facts, to compare the result of various modes of treatment, [...] are too obvious to be dwelt upon. (Alcock, 1823, p. 99)

Todd, a former naval physician, that is, hierarchically a subordinate of Blane, saw the dawn of a future science founded upon this practice, provided students were ‘*Thoroughly disciplined in classical[!] and mathematical learning*’ (my italics) (Todd, 1831, p. 121, 159). Alcock mentioned probability *en passant* in a

footnote (p. 78). Neither dealt explicitly with quantification. Yet their endeavour implied unconscious probabilistic reasoning.

By 1830, the movement found a second textbook-like summary in Francis Bisset Hawkins’s *Elements of Medical Statistics* (1829). In this updated book in English on medical statistics, the young London physician (b.1796) had delivered its contents as the Royal College of Physicians’ Gulstonian Lecturer of the previous year. He summarised the status quo as follows:

Statistics has become the key to several sciences. [...] And there is reason to believe that a careful cultivation of it, in reference to the natural history of man in health and disease, would materially assist the completion of a philosophy [science] of medicine [...] Medical statistics affords the most convincing proofs of the efficacy of medicine. [And he specified:] If we form a statistical comparison of fever treated by art, with the results of fever consigned to the care of nature, we shall derive an indisputable conclusion in favour of our profession. (Hawkins, 1829, pp. 2–3)

If the word ‘statistical’ were replaced by ‘arithmetic’, or ‘numerical’ in the above sentences, it might well have been written 50 years earlier by a prolific and militant writer on the subject, John Millar (b.1733), another Scottish physician at the London Dispensary.<sup>5</sup>

So, clearly, there was methodological awareness in Britain tied to probabilistic thinking throughout all these decades, mostly in an unconscious mode. It is therefore not surprising that Louis’s work was scrutinised in Britain.

(To be continued).

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## Note

- a. The series on probabilistic thinking and the evaluation of therapies, 1700-1900, will appear as separate articles in forthcoming issues of the JRSM.

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