

Claude Bernard, statistics and comparative trials

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Claude Bernard's (1813–1878) *Introduction à l'étude de la médecine expérimentale*¹ is commonly misinterpreted as criticising the use of statistics in medicine and the quantified research practice that would later lead to clinical epidemiology. There are indeed statements in the *Introduction* that apparently lend support to such interpretation. For example, we can read that: 'In a word, if based on statistics, medicine can never be anything but a conjectural science' (Bernard,¹ p. 197, Bernard,² p. 139). But these statements are qualified by others demonstrating that Bernard advocated the use of statistics to assess the efficacy of medical treatments. For example, Bernard wrote:

Of course, statistics may guide the physician's prognosis; to that extent they are useful. I do not therefore reject the use of statistics in medicine, but I condemn not trying to get beyond them and believing in statistics as the foundation of medical science. (Bernard,¹ p. 196, Bernard,² p. 138)

These statements may seem to contradict each other if not placed within Bernard's evolutionary vision of medicine.³ Bernard considered 'empirical' medicine, based on comparative experiments and statistics, as an intermediary stage between mere 'tact and intuition' and 'scientific medicine'. The latter, ideally, would be strictly based on experimental evidence, and therefore on the exact knowledge of the physiological mechanisms underlying a specific disease process or the therapeutic effect of a drug. The itch was a typical example of the stages of evolution of medical knowledge:

Formerly we knew the itch only empirically. Then we guessed about lesions in the itch and collected statistics on the value of one salve or another for curing the disease. Now that the cause of the itch is known and experimentally determined, it has all become scientific and empiricism has disappeared (...) we cure it always without exception... (Bernard,¹ p. 268, Bernard,² p. 214)

Bernard absolutely rejected the use of statistics in physiology. When the results of repeated experiments conflicted, the physiologist had to explain why they varied and not hide the variation in averages. But he was also aware that it would take a long time before medicine as a whole would become scientific. In the meantime, physicians had to take care of patients, establish diagnoses and select treatments even when they did not know the proximal cause of the disease and the mode of action of their treatment. Medical practice had a huge speculative component, which Bernard referred to as 'empirical', and which he predicted would represent the bread and butter of the clinician's activity for a long time to come. Bernard had a realistic approach of empirical medicine:

'Conjectural medicine must necessarily precede exact medicine, which I call experimental medicine because it is based on the experimental determination of the cause of disease. In the meantime, we must resign ourselves to practicing conjectural or empirical medicine' (Bernard,¹ p. 298, Bernard,² p. 214).

Empirical medicine could only be based on group comparison and probabilistic thinking:

Such is the state of empirical medicine, which is conjectural medicine because it is based on statistics which collect and compare cases which are analogous or more or less similar in their outer characteristics, but undefined as to their immediate cause. (Bernard,¹ p. 298, Bernard,² p. 214)

For Bernard, empirical medicine was an evolutionary stage of medicine, which would 'never totally disappear from any science' (Bernard,¹ p. 268, Bernard,² p. 191). He even praised clinicians who had 'the scientific spirit' and used evidence derived from comparative experiments, and in particular comparative therapeutic trials:

For comparative experiment is the *sine qua non* of scientific experimental medicine; without it a

physician walks at random and becomes the plaything of endless illusions. A physician, who tries a remedy and cures his patients, is inclined to believe that the cure is due to his treatment. Physicians often pride themselves on curing all their patients with a remedy that they use. But the first thing to ask them is whether they have tried doing nothing, i.e., not treating other patients; for how can they otherwise know whether the remedy or nature cured them? (Bernard,¹ pp. 272–273, Bernard,² p. 194)

Bernard referred without naming him to the slightly older Parisian doctor, Pierre-Charles-Alexandre Louis. He praised the experiment in which Louis assessed whether early bloodletting in the course of a pleuropneumonia had a beneficial effect on duration of the disease or survival:⁴

We may be subject daily to the greatest illusions about the value of treatment, if we do not have recourse to comparative experiment. I shall recall only one recent example concerning the treatment of pneumonia. Comparative experiment showed, in fact, that treatment of pneumonia by bleeding, which was believed most efficacious, is a mere therapeutic illusion. (Bernard,¹ p. 273, Bernard,² p. 194)

With Bernard's evolutionary vision of medicine in mind, we are able to interpret his apparently negative

statements about medical statistics in their proper context. Overall, Bernard was a strong and explicit proponent of the importance of scientific evidence in medical knowledge, be it from experiments or from comparative trials.

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