

Austin Bradford HILL

b. 8 July 1897 - d. 18 April 1991

Summary. Bradford Hill was the leading proponent of randomized clinical trials during the mid-20th century, and conducted important epidemiologic surveys especially for the health effects of smoking. His writings were very influential.

By the end of the 1930's Bradford Hill had achieved distinction as a respected medical statistician who had written an influential introductory book on the subject. During the next 25 years he occupied an undisputed place as the leading medical statistician, a position justified by the important developments he initiated in epidemiology and clinical trials and the consequent contributions to medical knowledge.

Hill was born in London and died in Cumbria, England. He was always known as 'Tony', and adopted the double surname 'Bradford Hill' later in life, and he came from a family of considerable distinction. His father, Sir Leonard Hill, was an eminent physiologist and Fellow of the Royal Society. His 19th century forebears included Sir Rowland Hill, who introduced the penny post in Great Britain. Hill had expected to follow his father in medicine, but, during wartime service with the Royal Naval Air Service, he contracted tuberculosis which led to a long period of convalescence. The prospect of a medical career having disappeared, he took a London University degree in economics, and obtained a post in a research group in industrial medicine under Major Greenwood, the leading medical statistician at that time.

Hill liked to tell people that he was trained in neither medicine nor statistics. He had attended lectures by Karl Pearson (q.v.), who greatly impressed him, but he never developed a liking for mathematical theory and in later life preferred to describe himself as an epidemiologist. During the inter-war period his research covered a wide range of epidemiological work, but centered on occupational health. He moved, with Greenwood, to the London School of Hygiene and Tropical Medicine, where he became a Reader in 1933. His lectures to postgraduate medical students were inspiring, and helped to persuade a generation of future public health workers of the central importance of the statistical approach. This vein of incisive exposition continued in a series of articles in the *Lancet*, which were published in book form in as *Principles of Medical Statistics* (Hill, 1937; Hill and Hill, 1991). This book, which was immensely successful, had minimal technical content, but

explained clearly the general principles of the subject and the problems of interpretation of statistical data.

After the war, during which he worked for the Royal Air Force, Hill succeeded Greenwood as Professor of Medical Statistics and directed the Statistical Research Unit of the Medical Research Council (MRC). Between 1945 and his retirement in 1961 he directed research in a number of major projects, many of which were funded by the MRC.

In 1946 he persuaded two MRC committees to launch randomized controlled trials, one in preventive medicine to test a pertussis (whooping cough) vaccine, the other in clinical medicine to assess the effect of streptomycin in the treatment of pulmonary tuberculosis. The report on the latter (Medical Research Council, 1948) is generally regarded as marking the first randomized trial (Armitage, 1992). Hill had advocated randomization in his book, although he had not initially distinguished clearly between strictly random allocation and the more suspect method of alternation. The streptomycin trial was an opportunity to clarify his thoughts, and there followed a remarkable stream of writing on the principles of clinical trials including practical and ethical problems, exemplified by further trials supported by the MRC and other bodies. Many of these accounts are included in a volume of selected papers (Hill, 1962).

Meanwhile he launched, with Richard Doll, a major case-control study (Doll and Hill, 1950), comparing lung cancer patients with matched controls, which showed conclusively that smoking was the predominant risk factor. This was followed by other case-control studies, and, again with Doll, a long-term prospective study of smoking and health which demonstrated that lung cancer was not the only disease to be caused by smoking. This cohort study, which continued for several decades, was conducted on British doctors, an ideal population whose cooperation was testimony to the respect with which Hill's work was regarded by his medical colleagues. As with clinical trials, Hill accompanied his work on specific epidemiological projects with expositions of the principles to be followed in this field of research (Hill, 1962). In particular, in Hill (1965) he proposed nine criteria which should be satisfied before one could confidently claim that an association between a disease and a risk factor was causative. Hill was by nature a cautious man, and he had been careful initially to claim that a causal effect of smoking on lung cancer was only one of a number of possible explanations for the association. As the evidence mounted he accepted the causal link as being overwhelmingly the most likely explanation, and was disturbed by sceptical remarks occasionally

expressed by eminent scientists unwilling to take a commonsense view of the matter.

Hill was elected Fellow of the Royal Society in 1954 and knighted in 1961. He was President of the Royal Statistical Society in 1950-52 and was honoured by many other learned institutions. After retirement he became one of the first members of the UK committee set up to regulate the safety of drugs, later known as the Committee on Safety of Medicines.

Hill made, during his career, little use of any but the simplest mathematical techniques, but gave strong support to colleagues whose inclination lay in that direction. His success was due to a combination of factors: enormous ability as a research strategist, able to see the right way to tackle a difficult problem and to develop the means of doing so; a remarkable facility with numerical data, which enabled him to see the essential features of data summaries without technical analysis; a very sharp intellect, highly effective in committee discussions; and a charming and witty personality engendering confidence amongst medical colleagues who might otherwise have resented the interventions of an ‘outsider’. His influence on younger colleagues was considerable, and his standing as a pioneer in the continued advance of quantitative medical research is unchallenged.

References

- [1] Armitage, P. (1992). Bradford Hill and the randomized controlled trial. *Pharmaceutical Medicine* **6**, 23-37.
- [2] Doll, R. and Hill, A. Bradford (1950). Smoking and carcinoma of the lung. Preliminary report. *British Medical Journal* **2**, 739-748.
- [3] Hill, A. Bradford (1937). *Principles of Medical Statistics*. London: Lancet.
- [4] Hill, A. Bradford (1962). *Statistical Methods in Clinical and Preventive Medicine*. Edinburgh and London: Livingstone.
- [5] Hill, A. Bradford (1965). The environment and disease: association or causation? *Proceedings of the Royal Society of Medicine* **58**, 295-300.

- [6] Hill, A. Bradford and Hill, I.D. (1991). *Bradford Hill's Principles of Medical Statistics*, 12th ed. London: Arnold.
- [7] Medical Research Council (1948). Streptomycin treatment of pulmonary tuberculosis: a report of the Streptomycin in Tuberculosis Trials Committee. *British Medical Journal* **2**, 769-782.
- [8] **Further Bibliography**
- [9] Doll, R. (1993). Sir Austin Bradford Hill, 1897-1991. *Statistics in Medicine* **12**, 795-808 [includes a bibliography of Bradford Hill's writings].
- [10] Doll, R. (1994). Austin Bradford Hill. *Biographical Memoirs of Fellows of the Royal Society* **40**, 129-140.
- [11] Hill, I.D. (1982). Austin Bradford hill - ancestry and early life. *Statistics in Medicine* **1**, 297-300.

Peter Armitage