

# THE LANCET

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## MATHEMATICS AND MEDICINE

STATISTICS are curious things. They afford one of the few examples in which the use, or abuse, of mathematical methods tends to induce a strong emotional reaction in non-mathematical minds. This is because statisticians apply, to problems in which we are interested, a technique which we do not understand. It is exasperating, when we have studied a problem by methods that we have spent laborious years in mastering, to find our conclusions questioned, and perhaps refuted, by someone who could not have made the observations himself. It requires more equanimity than most of us possess to acknowledge that the fault is in ourselves. A colleague of a famous contemporary statesman has been quoted as complaining that he used figures as though they were adjectives. The medical profession as a whole would not find it easy to counter a similar charge. For most of us figures impinge on an educational blind spot. We have never been taught to recognise them for what they are. This is a misfortune, because simple statistical methods concern us far more closely than many of the things that we are forced to learn in the six long years of the medical curriculum. Many of our problems *are* statistical; and there is no other way of dealing with them. In preventive medicine this is so obvious that it has acquired general recognition. In laboratory work, though recognition has come more slowly, it is now widely realised that it is very unsafe to base conclusions on statistically inadequate data. In clinical medicine recognition is coming more slowly still; so slowly that many avoidable errors, and a sad waste of material, still hinder progress.

The kind of problem that demands statistical treatment is familiar to all of us. What is the therapeutic value of antipneumococcal or of anti-streptococcal serum? What is the expectation of life of patients who are operated on for carcinoma at various sites and in various stages of development? What are the relative merits of artificial pneumothorax or thoracoplasty in the treatment of phthisis? In all such problems, and they could be multiplied ad nauseam, the unknown, or uncontrollable, variables are so many that no sound conclusion can be based on the observation of a few cases, or on the uncritical assessment of many. Clinical science, like any other, is essentially experimental. We do things to our patients and we see what happens. It has become a truism that the history of a science is the history of its technique; and the technique of seeing what happens when we attempt to control disease is as yet very poorly developed. Because it is poorly developed we still do many things that we ought not to do,

and leave undone much that ought to be done. The omission from the medical curriculum of a short course in statistical methods has led to an unfortunate misconception of the real difficulty that we have to face. It is sometimes supposed, by those who have conquered their repugnance to statisticians and all their works, that our technical problem can be solved by passing over our figures to a mathematical expert, and letting him do his best, or worst, with them. That way there is no real salvation. The mathematical statistician is trained to deal with numerical observations as such. He can expose statistical fallacies; and, by inquiry, he can often get behind the face value of the figures and allow for factors that are not immediately obvious from the tabulated findings. But his ignorance of medicine makes it as difficult for him to appreciate all the possible sources of error as it is for the medical man who knows no statistics to assess the real significance of his figures. Much can, of course, be done by the method of liaison, especially when it is close and understanding; but, to be fruitful, it demands some knowledge of statistical methods on the one hand, and some experience of medical problems on the other. In the form in which it is too commonly practised it has another fatal disadvantage. The statistician who is presented with a mass of figures from a long and laborious inquiry has not infrequently to report that they are of little or no value because they have been wrongly collected. The time to allow for statistical factors is when an inquiry is being planned, not when it is completed.

In this issue we commence the publication of a series of articles by Mr. A. BRADFORD HILL, D.Sc., of the London School of Hygiene, which will, we hope, be of service to those who desire to gain an insight into the application of simple statistical methods to problems of the kind that face them in their daily work. In his earlier articles Dr. HILL sets out, in simple terms and with a minimum of mathematics, the various methods that the statistician employs in assessing the significance of numerical results, illustrating each method by examples which will be of interest to the medical practitioner, or medical officer of health. In his later articles he considers a number of common fallacies, and difficulties of interpretation, that arise in dealing with data of this kind. We believe that this clear exposition, by a statistician who has had a wide experience of the problems with which medical men have to deal, and of the difficulties which post-graduate medical students encounter in grasping statistical principles, will be welcomed by many of our readers.

## ORAL SEPSIS

WHEN OKELL and ELLIOTT<sup>1</sup> showed that a patient with pyorrhœa usually has organisms in his blood after tooth extractions—and sometimes even in the absence of any deliberate trauma—it was obvious that their findings might alter the outlook on oral sepsis. If it was easy for living

<sup>1</sup> Okell, C. C., and Elliott, S. D. (1935) *Lancet*, 2, 869.