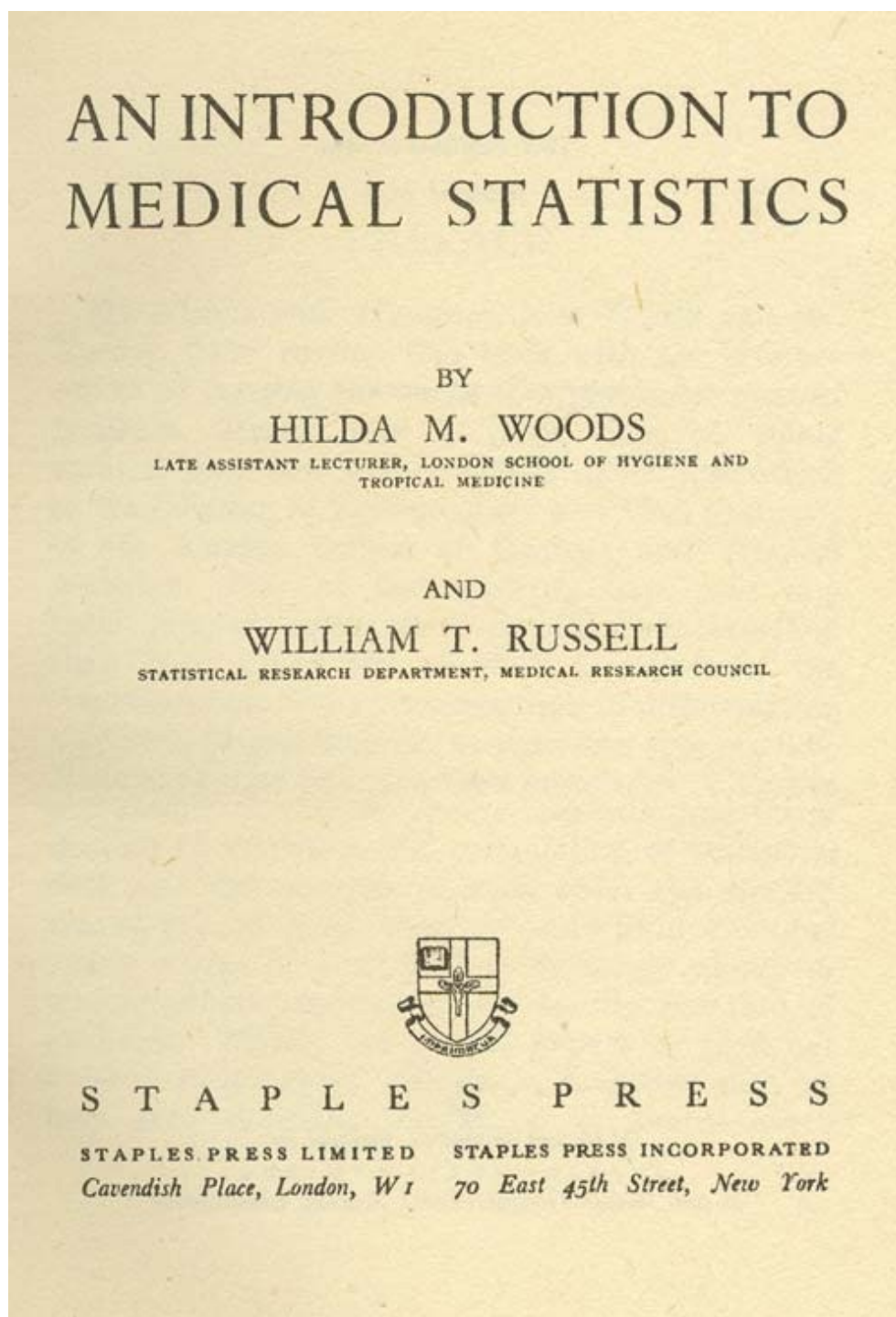


Woods HM, Russell WT (1931). An introduction to medical statistics. London: Staples Press.

Title pages**Key passages**

In case 2, the sample of 100 with 10 deaths, we have expected deaths 20, observed deaths 10, difference 10. The standard deviation this time is the square root of $100 \times .8 \times .2$ or of 16, viz. 4, the ratio of the deviation to the standard deviation is therefore 10 divided by 4, viz. 2.5. Our table tells us to expect this only six times in a thousand trials, or the odds against such an occurrence by chance are 167 to 1. Hence we can reasonably say that the treatment was effective.

But, the reader will note, *he* must be the judge whether these odds are so heavy that he is justified in coming down on the side of the physician, and that it is mere nonsense for him, or for anybody else, to say dogmatically that the result proves mathematically that the treatment was effective. He *must* remember that he is weighing alternatives. Suppose, for instance, that the treatment consisted in administering a dose of coloured water to each patient, and that in a particular experiment our arithmetical method gave odds of ten thousand to one against so low a fatality emerging in a sample of the given size; suppose further (a very drastic supposition) that one knew that the law of expected fatality was really applicable to the class of patients under treatment. Are we forced to infer that coloured water cures typhoid? Of course not. An improbable event has happened indeed, but the alternative to accepting it as a mere chance event would be to dismiss the whole body of knowledge acquired with respect to the pathological and physiological processes of the body, and the probability that this knowledge is all folly might well be—if we could measure it very much less than one in ten thousand. In other words, the probability of the event being a chance happening might be immensely greater than the probability that the fundamental hypothesis was wrong. One is weighing *alternatives*.

Many people say that a difference from expectation greater than three times this probable error, or twice the standard deviation, is "significant," meaning merely that the chance of it happening (as determined above) is small. This is quite arbitrary. It is much better in any important case to state the arithmetical facts as revealed by the standard deviation.