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STATISTICAL METHODS IN MEDICAL RESEARCH

I. QUALITATIVE STATISTICS (ENUMERATION DATA)

By Donald Mainland

CANADA

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STATISTICAL METHODS IN MEDICAL RESEARCH

I. QUALITATIVE STATISTICS (ENUMERATION DATA)[1]

BY DONALD MAINLAND[2]

Abstract

This article is designed to help investigators in applying to qualitatively classified clinical and laboratory data the appropriate statistical treatment—tests of significance in binomial and multinomial distributions, estimation of confidence limits, analysis of contingency tables, and estimation of sample sizes required for further investigation. Section A is a brief introduction (definitions and principles). Section B comprises 40 examples classified so that the investigator can choose data and problems comparable to his own. Questions that arise in the examples, regarding experimental design (especially random sampling) and the interpretation of the tests, are discussed in Section C (Notes).

Because the standard deviation of the binomial and the chi square contingency test are often used without appreciation of the risk entailed, tables, which can be used also in nonmedical investigation, are presented: binomial confidence limits (with graphs) and exact probabilities for small-sample fourfold contingency tables. For samples not covered by the tables, precautions and rules regarding the use of chi square have been derived from more than five hundred comparisons between chi square and the exact method. To help in the exact computation of probabilities where that is necessary, four-decimal logarithms of factorials of numbers up to 1000 are given.

Contents

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Contribution from the Anatomy Department, Dalhousie University, Halifax, N.S. Prepared for the Division of Medical Research of the National Research Council, with the aid of grants from the Council.
[2] *Professor of Anatomy.*

Contents—*Concluded*

A well-designed experiment contains in itself its estimate of error, and a procedure such as the following could be suggested:

(*a*). If it is desired to select the apparently more susceptible men, do so by a preliminary test.

(*b*). Allocate in advance to the selected group, *strictly at random*, treatment and nontreatment. This takes care of all such factors as variable degrees of susceptibility, activities before the test and time of day when the test is made. Even loss of men owing to unforeseen circumstances (unless associated with their susceptibility to motion sickness) does not introduce a bias, although it removes the advantage of equal numbers.

(*c*). Compare the two samples as in the Examples indicated under that heading in the Summary of Examples (Subsection 2).

(*d*). If there is a significantly greater immunity in the drug-treated men, estimate for them the confidence limits as shown in the present example. The answers will show estimates of immunity *after* the drug, not necessarily wholly *due to* the drug, even if the nontreated men, in the particular experiment, all developed motion sickness.