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Chi-square

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Definition

The chi-square (χ^2) test is a nonparametric statistical method primarily used to evaluate frequency data for categorical variables, by examining the differences between observed and expected frequencies for each category. A one-way chi-square test is used to determine whether differences in frequencies across levels of a nominal variable are due to chance (the null hypothesis) or represent a true difference (the alternative hypothesis). The chi-square is calculated by dividing the squared difference between the observed and expected frequency by the expected frequency in each category and summing the results ($\chi^2 = \Sigma((O - E)^2/E)$). When two variables are involved, a contingency table is constructed, depicting the observed frequency and the expected frequency in each cell. The chi-square is calculated again by, within each cell, squaring the difference between the observed and expected frequency and dividing by the expected frequency, and then summing each result.

Current Knowledge

An underlying assumption of the chi-square test is that the observations in the sample are independent of each other. Additionally, the chi-square test requires that the sample is sufficiently large. Although various rules of thumb are available to determine an adequate sample size, a common guideline is to have expected frequencies of at least five in at least 80% of cells, with no expected frequencies less than one.

See Also

- ▶ Contingency Tables
- ▶ Correlation Coefficients
- ▶ Nonparametric Statistics
- ▶ Statistical Significance

Further Readings

Campbell, I. (2007). Chi-squared and Fisher-Irwin tests of two-by-two tables with small sample recommendations. *Statistics in Medicine, 26*, 3661–3675.

Cochran, W. G. (1952). The χ^2 test of goodness of fit. *Annals of Mathematical Statistics, 25*, 315–345.

McHugh, M. L. (2013). The chi-square test of independence. *Biochemical Medicine, 23*, 143–149.

J. Kreutzer et al. (eds.), *Encyclopedia of Clinical Neuropsychology*,
DOI 10.1007/978-3-319-56782-2_1179-3