

Severity evaluations based on quantiles

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Abstract

Post-data appraisal of discrepancies from the null hypothesis warranted by the data has been proposed by Maio and Spanos to counteract common statistical fallacies related to interpretation of test results (reject/don't reject). Although widely applicable, the severity principle has not received sufficient attention by health researchers routinely drawing their inferences based on error statistical methods. Aim of this presentation is to express the severity principle in terms of quantiles of the sampling distribution in the hope to make it more accessible and used in practice.

Severity principle (weak). Data do not provide good evidence for the truth of null hypothesis if the test had very little chance of providing evidence against the null hypothesis, even if the null hypothesis is false. Said differently, an empirical estimate is not an extreme quantile of the sampling distribution under the null hypothesis and it is not an extreme quantile of the sampling distribution under the alternative hypothesis.

Severity principle (full). Data provides good evidence of a certain discrepancy from the null hypothesis to the extent that such a discrepancy passes the test with a high probability based on the data at hand. That is, an empirical estimate is an extreme quantile of the sampling distribution under the null hypothesis and it is an extreme quantile of the sampling distribution under a certain alternative hypothesis.

The severity principle will be presented with motivating examples arising in the field of epidemiology and public health research. Relation with traditional confidence intervals as well as pros and cons of conducting a severity evaluation using quantiles will be discussed.

By encouraging the investigator to locate a particular sample in an hypothetical sampling distribution, a quantile-based post-data severity evaluation can lead to a better understanding of the classic behavioristic approach to statistical tests and, eventually, to complement it.

Keywords

severity, quantiles, sampling distribution, public health