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# The posterior probability of a null hypothesis given a statistically significant result

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## Abstract

When researchers carry out a null hypothesis significance test, it is tempting to assume that a statistically significant result lowers Prob(H0), the probability of the null hypothesis being true. Technically, such a statement is meaningless for various reasons: e.g., the null hypothesis does not have a probability associated with it. However, it is possible to relax certain assumptions to compute the posterior probability Prob(H0) under repeated sampling. We show that the intuitively appealing belief, that Prob(H0) falls when significant results have been obtained under repeated sampling, is in general incorrect and depends greatly on: (a) the prior probability of the null being true; (b) Type I error, and (c) Type II error. Through simulation we quantify uncertainty and find that uncertainty about the null hypothesis often remains high despite a significant result. To help the reader develop intuitions about this common misconception, we provide a Shiny app (https://danielschad.shinyapps.io/probnull/).