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Bayesian statistical inference enhances the interpretation of contemporary randomized controlled trials.

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Abstract

OBJECTIVE: Randomized trials generally use "frequentist" statistics based on P-values and 95% confidence intervals. Frequentist methods have limitations that might be overcome, in part, by Bayesian inference. To illustrate these advantages, we re-analyzed randomized trials published in four general medical journals during 2004.

STUDY DESIGN AND SETTING: We used Medline to identify randomized superiority trials with two parallel arms, individual-level randomization and dichotomous or time-to-event primary outcomes. Studies with $P < 0.05$ in favor of the intervention were deemed "positive"; otherwise, they were "negative." We used several prior distributions and exact conjugate analyses to calculate Bayesian posterior probabilities for clinically relevant effects.

RESULTS: Of 88 included studies, 39 were positive using a frequentist analysis. Although the Bayesian posterior probabilities of any benefit (relative risk or hazard ratio < 1) were high in positive studies, these probabilities were lower and variable for larger benefits. The positive studies had only moderate probabilities for exceeding the effects that were assumed for calculating the sample size. By comparison, there were moderate probabilities of any benefit in negative studies.

CONCLUSION: Bayesian and frequentist analyses complement each other when interpreting the results of randomized trials. Future reports of randomized trials should include both.

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