TITLE: Effective sample size of Bayesian studies

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ABSTRACT:

In Bayesian statistics, the effective sample size (ESS) for a parameter (e.g., treatment effect) is the size of the data that the Bayesian analysis effectively used in estimating the parameter based on its posterior distribution. Malec (Stat Med. 2001) defined ESS as the sample size N times the ratio of the posterior variances of the parameter when its prior information is ignored vs. when it is utilized. This definition is natural because under common data sampling designs the variance of an estimator is approximately inversely proportional to sample size. Subsequent definitions have been based on comparing the Fisher information contained in the likelihood and the prior (Morita et al 2008; Neuenschwander et al 2020). We propose that effective sample size be defined in terms of the posterior variance for the parameter. For example, for a binomial proportion, ESS is defined as (posterior mean)*(1 – posterior mean)/ (posterior variance). When defined in this way, the posterior distribution of ESS can be obtained and monitored easily as data accumulate