Bayesian statistics in oncology: a guide for the clinical investigator

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The rise of evidence-based medicine as well as important progress in statistical methods and computational power have led to a second birth of the >200-year-old Bayesian framework. The use of Bayesian techniques, in particular in the design and interpretation of clinical trials, offers several substantial advantages over the classical statistical approach. First, in contrast to classical statistics, Bayesian analysis allows a direct statement regarding the probability that a treatment was beneficial. Second, Bayesian statistics allow the researcher to incorporate any prior information in the analysis of the experimental results. Third, Bayesian methods can efficiently handle complex statistical models, which are suited for advanced clinical trial designs. Finally, Bayesian statistics encourage a thorough consideration and presentation of the assumptions underlying an analysis, which enables the reader to fully appraise the authors’ conclusions. Both Bayesian and classical statistics have their respective strengths and limitations and should be viewed as being complementary to each other; we do not attempt to make a head-to-head comparison, as this is beyond the scope of the present review. Rather, the objective of the present article is to provide a nonmathematical, reader-friendly overview of the current practice of Bayesian statistics coupled with numerous intuitive examples from the field of oncology. It is hoped that this educational review will be a useful resource to the oncologist and result in a better understanding of the scope, strengths, and limitations of the Bayesian approach.