A new Bayesian adaptive decision-theoretic design for multi-arm multi-stage clinical trials illustrated by an application in exercise oncology

Multi-arm clinical trials investigate multiple interventions in a single trial and provide efficiency gains over running separate single- or two-arm trials for each intervention. To further increase efficiency, multi-arm multi-stage trials generally include interim analyses that facilitate timely stopping and dropping of futile intervention arms from the trial. We developed a new Bayesian adaptive decision-theoretic approach to multi-arm multi-stage trials (Bassi et al. 2021). The basic idea is that after each stage a decision about the continuation of the trial is made on the basis of the expected reduction in loss. The loss function can incorporate costs for patient accrual as well as costs associated with an incorrect decision at the end of the trial. The design can be used for trials that aim to select the best among a set of intervention arms as well as trials that aim to separately compare multiple intervention arms to a common control arm. Simulation studies showed that this design increases the probability of making a correct decision at the end of the trial as compared to nonadaptive designs and adaptive two-stage designs. The performance was also evaluated by means of a re-analysis of a multi-arm trial that compared the effectiveness of multiple exercise programs for breast cancer patients receiving chemotherapy (Buffart et al. 2023)

References

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