Model uncertainty in health economic decision models

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Health economic decision models are used to evaluate medical interventions and allocate resources on the basis of expected lifetime costs and effectiveness. They are subject to considerable uncertainty, aggravated by the need to extrapolate short-term evidence from clinical trials. Uncertainty arising from the choice of model structure is usually only described by presenting the results under a series of alternative scenarios. In this work we describe how model uncertainty can be accounted for using model averaging based on formal measures of fit to data. Such measures are either intended to assess predictive ability, for example, AIC and cross-validation, or identify the "true model", for example, Bayes factors and BIC. We argue that the predictive approach is more suitable when modelling the complex underlying processes of interest in health economics, such as individual disease progression and response to treatment. We present a decision model which compares two surgical techniques for repairing abdominal aortic aneurysms, applying model averaging using classical parameter estimation and AIC. An extension to a fully Bayesian setting is described. As well as accounting for parameter uncertainty formally, the Bayesian framework facilitates the inclusion of expert judgements about uncertainties which are poorly identifiable from data, such as the choice of evidence to incorporate in the model.

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