FORMAL OBJECTIVE BAYESIAN METHODS IN COST-EFFECTIVENESS STUDIES

C. Armero*†, G. García-Donato*† and A. López-Quílez*†

(*) Centro Superior de Investigación en Salud Pública (CSISP). Valencia, Spain; (†) Universitat de València. Valencia, Spain; (‡) Universidad de Castilla-La Mancha. Albacete, Spain

1. Motivation

- The “lack of objectivity” has been frequently argued as the main concern precluding the adoption of Bayesian techniques in pharmacoeconomy.

- However this legitimate concern has inspired a fruitful area of research in the statistical community: the development of formal objective Bayesian methods.

- In this work, we
  - analyze how these methods accommodate the needs of pharmacoeconomic studies,
  - fully develop the methodology in two important cost effectiveness (CE) problems,
  - study the differences with other approaches to PSA.

2. The problem

- A great number of CE studies use complex decision models, which is a joint density for the outcomes cost and effectiveness, given a number of unknown calibration parameters (θ) like transition probabilities.

- The complex decision models are used as a device to produce simulated observations of cost and effectiveness of hypothetical cohorts under study. Examples of these models are the decision trees and the Markov models.

- In a probabilistic sensitivity analysis of a CE study the key question is how to assign the probability density of θ (to be denoted p(θ)).

- This density should reflect objectively relevant historical data about θ (eg. clinical trials).

3. Approaches to assign probability densities for calibration parameters

- Two stage approach: adjust a triangular density (or similar) to confidence intervals obtained from the historical data.

- Comprehensive decision modeling: assign p(θ) as the posterior distribution, with respect to some ‘vague’ or ‘flat’ prior.

Illustrative example I: Survival analysis

Kamath et al (2003) perform a CE analysis regarding several treatments of asymptomatic knee osteoarthritis. They use a decision tree with effectiveness the number of upper gastrointestinal (UGI) adverse events averted. We focus on θ, the probability of developing an UGI event in the six months after starting the treatment with ibuprofen. The historical data used is the CLASS study, a survival analysis with 1985 patients enrolled.

Objective Bayesian approach

We derive an objective posterior distribution for θ, based on a Weibull model for the data in CLASS and the formal objective prior obtained by Sun (1997).

Comparison with other approaches

Kamath et al (2003), adjust a triangular distribution (two stage approach).

Illustrative example II: Meta analysis

Goeree et al (1999) perform a CE study concerning several strategies for the management of patients with gastro-oesophageal reflux disease (GORD). A key parameter is θ, the GORD healing probability at 12 weeks with ciprofloxacin. The historical data corresponds to 9 different trials with a total of 211 patients.

Objective Bayesian approach

We obtain an objective posterior distribution for θ, based on a normal random effects model (suggested by Briggs et al 2002) and a formal objective prior proposed by Bayarri et al (2007).

Comparison with other approaches


FORMAL OBJECTIVE BAYESIAN: Assign p(θ) as the posterior distribution with respect to a formal objective prior.

A formal objective prior is a distribution derived by using some formal rules. They do not contain any extra information and have a number of good properties.