Optimal healthcare decisions: comparing medical treatments on a cost–effectiveness basis

Elías Moreno
Universidad de Granada, Spain
emoreno@ugr.es

F.J. Girón
Universidad de Málaga, Spain
fj_giron@uma.es

F.J. Vázquez–Polo
Universidad de Las Palmas de G.C., Spain
fjvpolo@dmc.ulpgc.es

M.A. Negrín
Universidad de Las Palmas de G.C., Spain
mnegrin@dmc.ulpgc.es

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Address for correspondence: Francisco–José Vázquez–Polo, PhD, University of Las Palmas de Gran Canaria, Department of Quantitative Methods, Campus de Tafira, 35017, Las Palmas de Gran Canaria, Spain; e–mail: fjvpolo@dmc.ulpgc.es.

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Abstract

This paper deals with medical treatments comparison from the cost–effectiveness viewpoint. A decision theory scheme is considered, where the decision space is the set of treatments involved, the space of states of nature consists of the respective net benefits of the treatments, and the utility function is one of two possible candidates. A first candidate is the one typically used in the literature on cost–effectiveness analysis, for which the utility of a decision is proportional to the net benefit gain, and a second one is of the type 0–1, which penalizes the wrong decisions with a fixed quantity. Their associated optimal decision rules, both frequentist and Bayesian, are analyzed and compared via frequentist evaluation of their performance. Illustrations with simulated and real data are provided.

Key Words: Bayesian analysis, cost–effectiveness of a treatment, healthcare, net benefit, optimal treatment, treatments comparison, utility functions.

1   Introduction

Due to scarce financial resources, medical treatments comparison are based not only on the effectiveness of the treatments but also on the cost of them (see, for instance, Drummond et al., 2005). Cost–effectiveness analysis has been used in the last two decades in healthcare scenarios (Spiegelhalter et al., 1994), and recently is also applied to some other areas such as the advanced computing (Phendharkar and Rodger, 2009). In the operational research literature some papers also address these techniques. Examples are those of Chalabi et al. (2008) and cites therein, who propose a two–stage stochastic mathematical programming formulation to solve the healthcare resource allocation problem. Brailsford and Harper (2008) presented a selected set of papers from the EURO Working Group on Operational Research Applied to Health Services.

Several measures for cost–effectiveness analysis of two given medical treatments have been proposed in the literature, and for a recent review see Willan and Briggs (2006). In this paper we focus on the optimal decision rules for comparing medical treatments based on their net benefit, a linear combination of the cost and effectiveness (Stinnett and Mullahy, 1998, Willan and Lin, 2001). We first consider the case of two treatments for which the decision space contains two decisions $\{d_1, d_2\}$, where d_i is the