A FLEXIBLE, DATA-PARSIMONIOUS MODEL FOR THE BUDGET IMPACT ANALYSIS OF NEW TECHNOLOGIES

Paolo Pertile
Department of Economics, University of Verona, Italy

MSR77

INTRODUCTION

Motivation

Being able to track the budget impact of innovation over time is often crucial. However, the methods most commonly adopted are not suitable to account for all the complications related to the dynamics of innovation adoption, especially when several therapeutic options exist. Although the ISPOR guidelines for BIA [1] suggest using Markov models in this context, they are very rarely adopted in practice. We characterise a general Markov model that can be used for several technologies and illustrate a data parsimonious implementation that provides promising results.

Aims

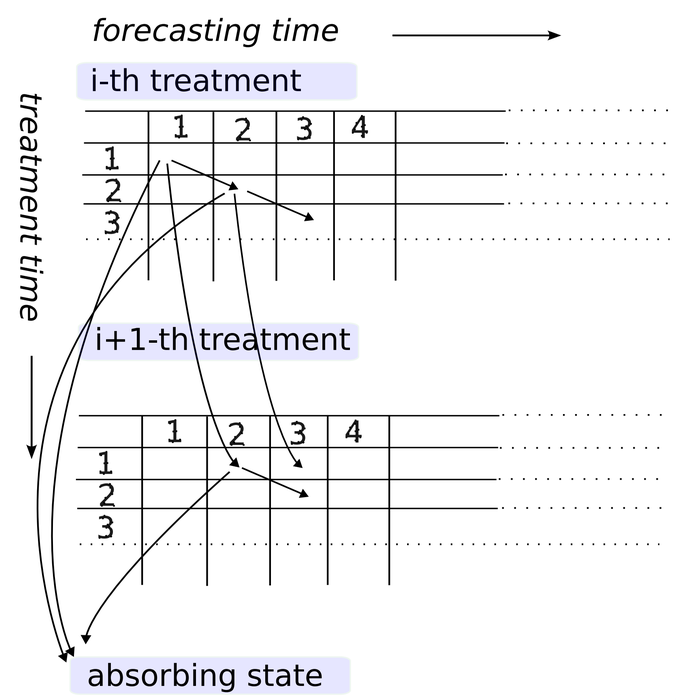
- providing a tool enabling the systematic use of Markov modelling for dynamic BIA even with scarce information
- tracking the budget impact of innovation over time
- allowing for complexity due to multiple treatments and multiple sequences of treatments
- accounting for other factors affecting the dynamics, e.g., Payment-by-Result (PbR), market penetration

Methods

The BIA is based on a comparison between two scenarios: WITH innovation vs. WITHOUT innovation.
For each scenario:
$s_j, \quad j = 1, \ldots, S$ indicates one of the *S* sequences of treatments
$m_{ij}, \quad i = 1, \ldots, M_j$ indicates treatment *i* belonging to sequence *j*
$t_{ij} = 1, \ldots, T_{ij}$ indicates time since the start of m_{ij}
$f = 1, \ldots, F$ indicates the forecasting period
p_{ijt} indicates the probability of shifting from treatment *i* to *i+1* (or absorbing state) after period *t*

Number of Markov states:

$$F \cdot \sum_{j=1}^{S} \sum_{i=1}^{T} S_j \cdot M_j \cdot T_{ij}$$



A DATA PARSIMONIOUS IMPLEMENTATION

Assumptions

1. only one sequence for each scenario (with and without)
2. constant hazard rates, estimated using only one point on the survival curve (e.g. median)
3. Period = month

This reduces the number of necessary inputs to:
- length of forecasting horizon
- # treatments per sequence
- prevalence and monthly incidence
- maximum length of each treatment
- patient cost per month of each treatment
- estimated median time in a treatment
- data on PbR agreement, if any
- months to reach full market potential
- estimated mkt share

Validation:

We consider a retrospective application of the tool to the problem of forecasting the pharmaceutical expenditure in the Veneto Region (IT) for Lenvatinib when its indication for Hepatocellular Carcinoma (HCC) was approved for use within the regional health system. Parameters are based only on information potentially available at the time of approval [2,3].

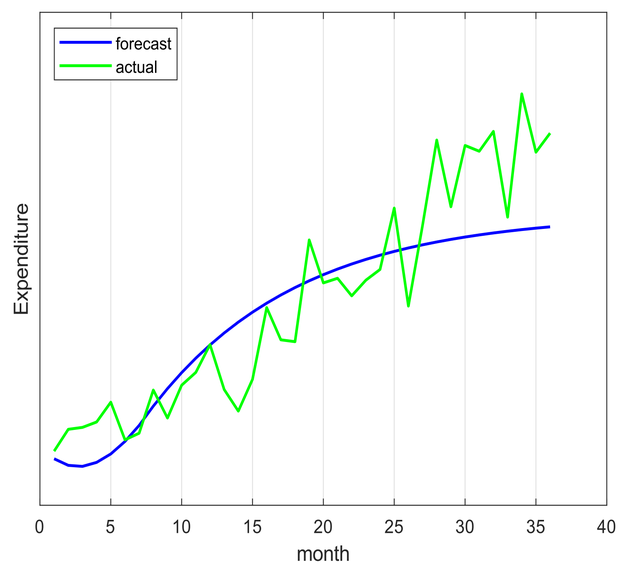
Sequence **without** Lenvatinib:

SORAFENIB → **REGORAFENIB**

Sequence **with** Lenvatinib:

LENVATINIB → **REGORAFENIB**

Figure 1: Actual and forecasted expenditure for Lenvatinib



AN EXAMPLE

Sequence **without** New treatment:

A → **B** → **C**

Sequence **with** New treatment:

New → **B** → **C**

Input data

- Forecasting period: 36 months
- Prevalence: 330
- Incidence (probabilistic): LogNormal (2.5, 0.08)
- Share of patients shifting to innovation: 80%
- Time to full mkt potential of innovation: 6 months

	A	B	C	New
median survival (in treat)	12	8	5	20
median overall survival	28	-	-	34
cost per month (000)	0.8	0.2	0.1	1.5-1.2
PbR after months	-	-	-	5
PbR rebate	-	-	-	100%

Results

Figure 2: Forecasted montlhy expenditure with and without innovation and 95% CIs

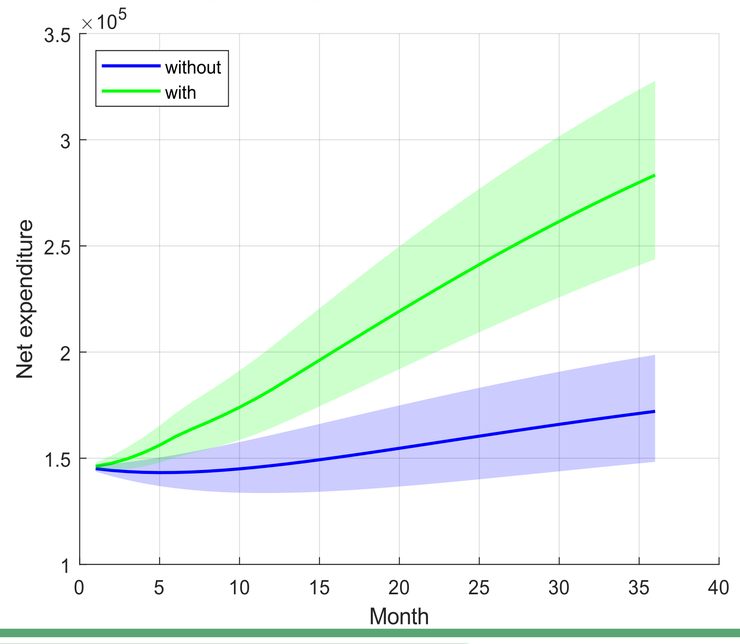
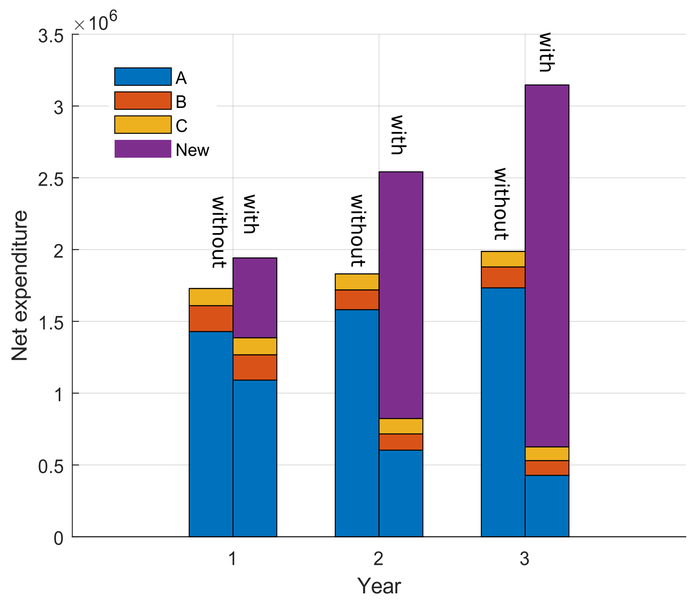


Figure 3: Yearly expenditure by treatment with and without innovation



CONCLUSION

We show that it is possible to characterise a general Markov model for the dynamic analysis of the budget impact of innovation. The model can be applied to several technologies and relies on a limited number of parameters typically available at the time of adoption. The model has been developed with a focus on innovation for cancer care, but it can be adapted to other settings. Hopefully, the adoption of this model and its future extensions will improve payers' and manufacturers' ability to predict the budget impact of innovation over time in complex settings.

References:

[1] Mauskopf et al. Principles of good practice for budget impact analysis: report of the ISPOR Task Force on Good Research Practices— Budget Impact Analysis. Value Health. 2007;10(5):336-347.

[2] https://www.regione.veneto.it/web/sanita/raccomandazioni-farmaci-oncologici

[3] Kudo, et al (2018). Lenvatinib versus sorafenib in first-line treatment of patients with unresectable hepatocellular carcinoma: a randomised phase 3 non-inferiority trial. The Lancet, 391(10126), 1163-1173.

Contacts:
paolo.pertile@univr.it
https://flash-project.com/

Acknowledgments:
The present work is part of the research activity of the project FLASH, funded by the European Union (G.A. 101095424). We are grateful to Azienda Zero and Regione Veneto for supporting the model validation.

UNIVERSITÀ di VERONA
Dipartimento di SCIENZE ECONOMICHE
FLASH
Funded by the European Union