

Advanced decision modelling in the context of Health Technology Assessment

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Introduction

Bringing a new health technology to market and into the hands of a patient is a long process. Most of the times patients, who have a medical need, ask themselves why does it take so long to make the health technology available to everyone. When a health technology is in the market, it usually took between 5 to 10 years to make it available.

Depending on the country, governments usually are involved in the reimbursement process. They usually ask the next questions when a new health technology is available:

- How much does it cost?
- Will it save lives and/or improve quality of life?
- Do we have enough budget to fund it?
- If we have a pool of interventions for a specific disease, which one/ones should we reimburse?

Moreover, physicians, patients, insurance plans, and advocacy groups play an important role when new technologies are available in the market (why?). Even though a new technology see the light (i.e. it has proved to be safe and effective), insurance providers or the government will not necessarily cover it. Usually they argue that the new technology is “Not cost-effective” or “Not have good value for money”. *These notes aim to provide all the necessary tools to decide if a new intervention has a good value-for-money.* It is important to stress that value-for-money decision is only one of many questions that are asked by one of the users of a **health technology assessment (HTA)**: patients, healthcare workers, government, and others.

Why reimbursement submissions fail?

According to Goeree (2015), the reasons for rejection are:

1. Inappropriate comparator. Lack of proper statistical analysis.

2. Inappropriate outcome. Use of surrogates.
3. Inappropriate analysis. Lack of robust evidence for costs and quality of life.
4. High cost to the government.

Topics of the course

1. What is HTA?
2. Introduction to decision-analytic models
3. Good practices in decision modelling
4. Evidence-based medicine
5. Decision tree-models
6. State-transition models with the Markov assumption
7. Partitioned survival models
8. Microsimulation
9. Discrete-event simulation
10. Uncertainty and decision-making
11. Presentation of results

Statistical computing

The use of open-source programming languages, such as **R**, in health decision sciences is growing and has the potential to facilitate model transparency, reproducibility, and shareability. However, realizing this potential can be challenging. Models are complex and primarily built to answer a research question, with model sharing and transparency relegated to being secondary goals. Moreover, many decision modelers are not formally trained in computer programming and may lack good coding practices, further compounding the problem of model transparency. **Therefore, throughout this course, the programming language R will be used to show its potential for advanced modelling in the context of HTA.**

To install **R** and **Rstudio**, you can follow the next link with instructions.

Evaluation

Item	Percentage	Due date
Assignment 1	15%	Nov 27, 2021
Assignment 2	15%	Dec 23, 2021
Take-home exam	30%	Jan 7, 2022

Item	Percentage	Due date
Project proposal	5%	Nov 22, 2021
Project presentation	5%	Jan 14, 2022
Final project	30%	Jan 17, 2022

The intent is to allow the students to demonstrate their mastery of this class through the following way. **Project proposal, presentation and final project will be done in pairs.**

Asssignments

The assignments are handed out approximately two weeks prior to the due date. Late work will not be marked, with the exception of an advance permission from the instructor.

Project proposal

(1 page)

The final deliverable for this course is a mini-HTA on a medical technology (preferably something topical), with a focus on the quantitative aspect of it. Given that the translation of a health policy question into a relevant research question is an essential first step in the conduct of HTA, students are required to formulate a research question and submit for grading purposes. This should include at least some of the following: an overview of the technology being assessed; a clear specification of the policy problem; and the research question(s) (including PICO) with objectives.

Project presentation

(20 minutes with extra 5 minutes for questions)

Students will be expected to present their final course paper and answer questions. Student will be graded on their presentations.

Final project

(20 pages double-spaced)

The main assignment will require students to produce a scaled down HTA, with a focus on the quantitative aspect of it. The objective of the final project is for the student to show that they have obtained a clear understanding of the advanced

methods in decision modelling in the context of HTA. More information will be provided throughout the course, but the paper should contain the following:

- a) Background and technology overview
- b) Formulation of the question you are trying to answer through your mini-HTA
- c) Review of the clinical literature
- d) Description of the structure of the model
- e) Description of the function of the model
- f) Results
- g) Conclusions

Bibliography

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Chapter 1

What is HTA?

1.1 Definition and rationale

The first thing that we need to know is the definition of a **health technology**. A health technology is any intervention that may be used to promote health, to prevent, diagnose or treat disease or for rehabilitation or long-term care.

Questions

1. List some examples of health technologies.

Depending on the agency, health technology assessment has a broad spectrum of definitions:

“HTA is a multidisciplinary process that uses explicit methods to determine the value of a health technology at different points in its lifecycle. The purpose is to inform decision-making in order to promote an equitable, efficient, and high-quality health system.” INAHTA

“Health technology assessment is a multidisciplinary process that uses explicit methods to determine the value of a health technology at different points in its lifecycle. The purpose is to inform decision-making in order to promote an equitable, efficient, and high-quality health system.” EUnetHTA

“A comprehensive, objective, evidence-based analysis of the clinical effectiveness, cost-effectiveness and broader impact of drugs, medical technologies and health systems. HTA examines technologies at all stages of their life cycle, from development through to maturity and obsolescence.” CADTH

The purpose of HTA is to support/help decision makers by identifying technologies that will improve health outcomes and deliver value for every dollar invested.

- Does a new health technology offer a clinical advantage over the alternatives/standard approaches?
- Is it worth the investment?
- Can I pay for it?
- Who would benefit from it?
- Any ethical, social or legal issues

But, what are the reasons for conducting HTAs?

- Increased demand for healthcare (why?)
- Soaring healthcare costs
- Increased rate of diffusion of new technologies and associated evidence

Once we have seen the definition and rationale for conducting HTAs, it is important to talk about the potential users.

- Government
- Managers in hospitals
- Healthcare workers
- Researchers

1.2 HTA process



Figure 1.1: Life expectancy in Mexico. Source: CONAPO

Chapter 2

Literature

Here is a review of existing methods.

Chapter 3

Methods

We describe our methods in this chapter.

Chapter 4

Applications

Some *significant* applications are demonstrated in this chapter.

4.1 Example one

4.2 Example two

Chapter 5

Final Words

We have finished a nice book.

Bibliography

Goeree, R. (2015). *Health technology assessment: using biostatistics to break the barriers of adopting new medicines*. CRC Press.