

An introduction to economic modelling in the context of HTA

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Host: COVID-END in Canada

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Outline

- Economic modeling & HTA (overview)
- Example: HTA process in BC
- Economic modeling process (five steps)
- Information base for the modeling
- Reviewing economic models
- Impact and summary

Decision analytic economic modeling and HTA

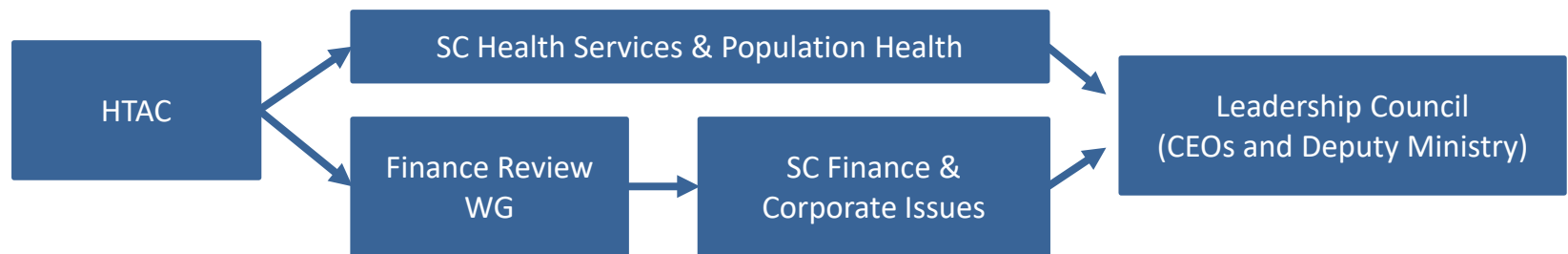
- In most cases clinical and economic evidence must be either transferred from one study population to another or combined and linked in some way – as such modeling becomes a viable option
- Decision makers must balance the costs and consequences of adopting or discarding a health technology based on the available data -> **HTA Process**
- HTA is a multidisciplinary process to evaluate the social, economic, organizational and ethical issues of a health intervention or health technology
- HTA has different parts (e.g., clinical effectiveness and economic evaluation) and different approaches (qualitative and quantitative including -> **Decision-analytic methods**)

Mathematical modeling in epidemiology

- Two main types of models in examining how infectious diseases progress through a population: deterministic and stochastic (accounts for chance variations)
- Based on assumptions around effectiveness of a given intervention (amongst other things) and thus validity is only as good as those assumptions
- Provides information as to which interventions to implement for how long, and have a place when empirical data can't be collected or prediction is required
- As we have seen with COVID modeling, these models can be updated regularly and can be an important part of the information base for public health responses
- All of that said, epidemiologic models are NOT the topic for today!

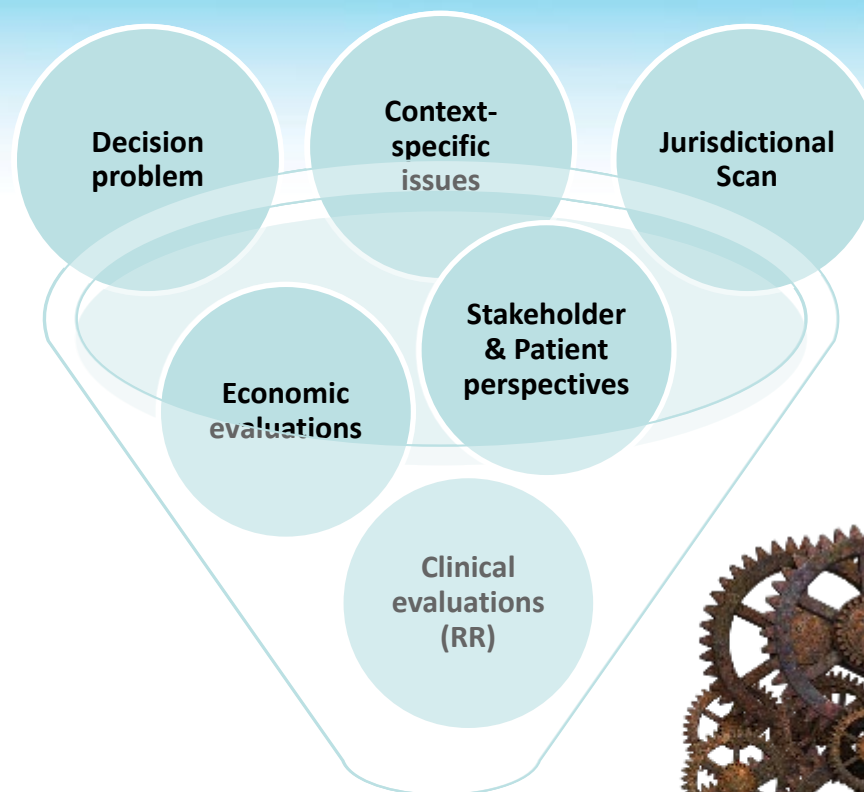
BC HTAC process and components

- New technologies and existing services (i.e., investment **and** reassessment)
 - Prioritization of topics by health technology assessment committee – 8-10 member advisory council, 2 public members, 5 secretariat members
 - BC Ministry has a defined set of criteria used to score the technologies
 - Condition severity
 - Evidence of effectiveness (health and non-health benefits)
 - Ethical considerations
 - Underserved populations
 - Evidence of cost-effectiveness
 - Environmental impact
 - Implementation considerations
 - Risk Registry



- 3 groups including C2E2 produce HTA reports (**4-6 month process**) for assessment by HTAC
- Public posting (review, redact, sign police communique, share publicly)

HTA Components



Decision-analytical model

BC-specific economic evaluation

BC-specific budget impact



- Non-linear process
- Time (4-6m) and resource (\$) constraints

Decision analytic modeling

- A decision-analytic model uses mathematical relationships to define and compare a series of expected consequences that would result from the set of interventions or decision options being evaluated, by synthesizing information from multiple sources
 - Common simulation techniques: discrete-event simulation (DES), Markov-Monte Carlo simulation, microsimulation, hybrid models
- To identify interventions that produce the greatest health care benefit with the resources available
- NOT a complete procedure for determining resource allocation decisions as it CANNOT incorporate all the values and criteria relevant to such decisions.

Decision analytic modeling

- Best understood as an aid in the complex decision making process and provides a framework for compiling clinical and economic evidence in a systematic fashion in a sensible way to reflect the context
- Alternative to trial based economic evaluation and is widely used, especially in situations where:
 - Lack of well-designed prospective, randomized, pragmatic cost-effectiveness studies that address the specific decision-in-need
 - A single trial might not compare all the available options, provide evidence on all relevant inputs, or be conducted over a long enough time to capture differences in economic outcomes (or even measure those outcomes).
 - Reliance on a single trial may mean ignoring evidence from other trials, meta-analyses, and observational studies

Decision analytic modeling in HTA

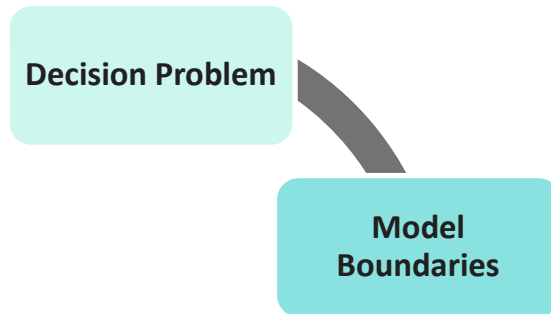
Decision Problem

Step 1: Specifying the decision problem

Policy Problem → *Decision Problem*

- Target population (s)
- The local context in which the technology will be used
- Defining options under evaluation
- Stakeholders/Institutions relevant to the decision making process

Decision analytic modeling in HTA

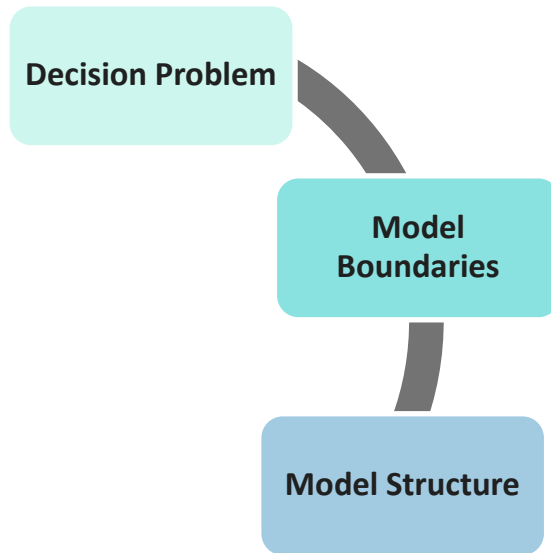


Step 2: Defining Model Boundaries

“Models are simplifications of reality”

- Specify consequences/outcomes which can be modeled.
- This process is informed by the *availability* and *quality* of clinical evidence to inform the treatment effect

Decision analytic modeling in HTA



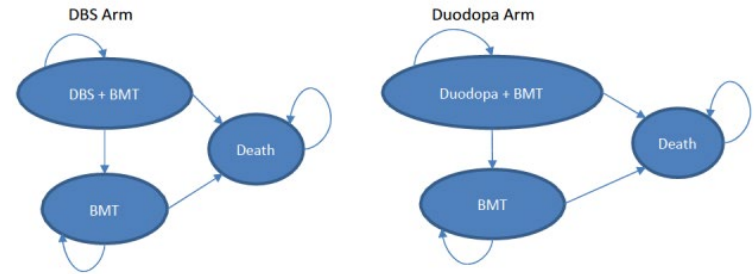
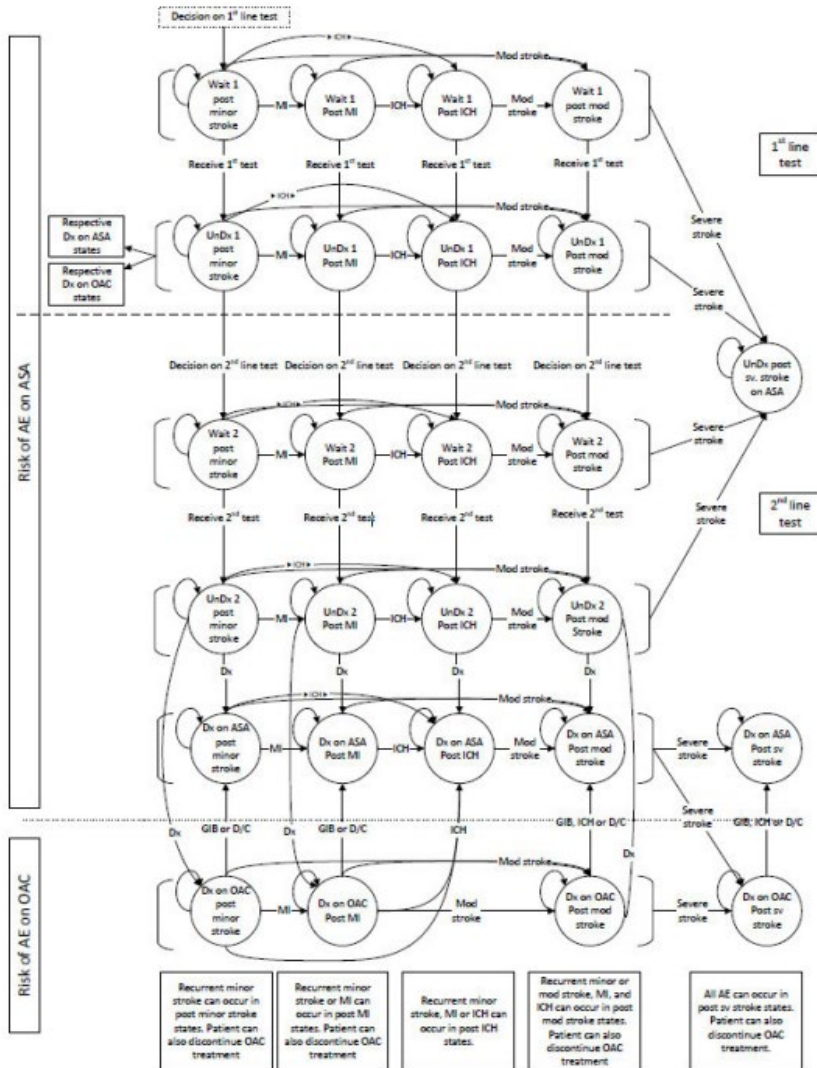
Step 3: Designing Model Structure

Reflect the underlying biological & clinical process in the model structure.

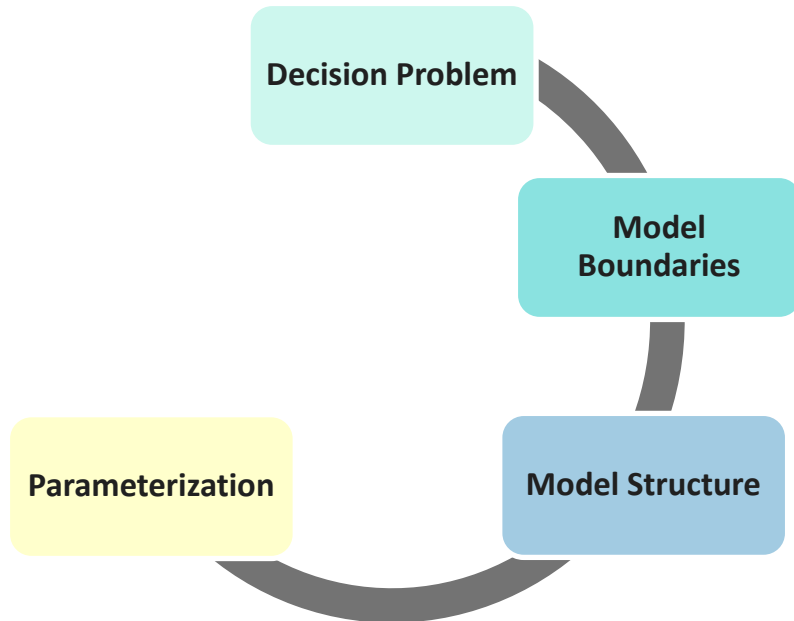
Key questions to consider:

- Chronic vs Acute disease?
- Does the risk of clinical events change over time?
- Does patient history matter?
- How was this clinical condition modeled before?

Models can be complex OR relatively simple



Decision analytic modeling in HTA

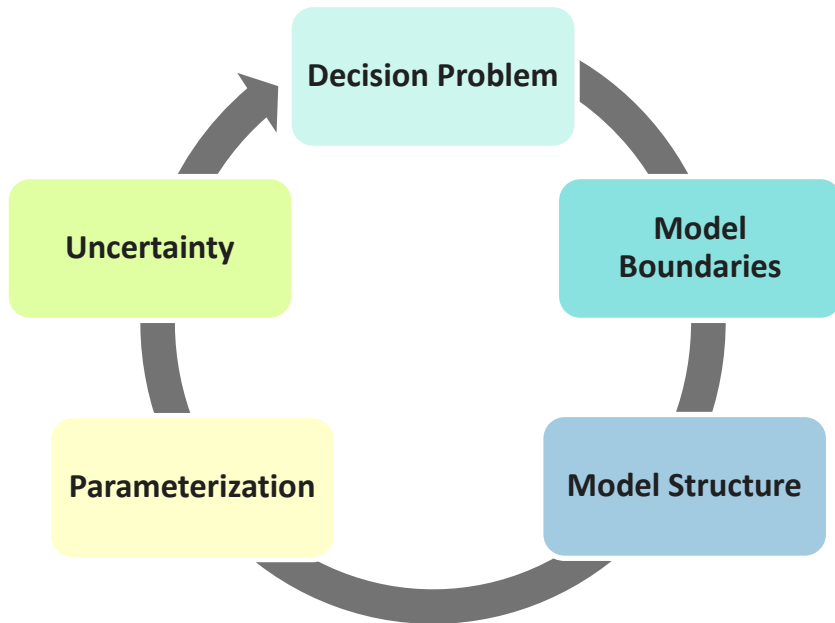


Step 4: Model Parametrization

Bring together all relevant evidence given the model structure

- Systematic identification of relevant evidence
- Clinical Evidence: synthesis where appropriate (ITC, NMA)
- Costing: Micro-costing vs. macro-costing

Decision analytic modeling in HTA



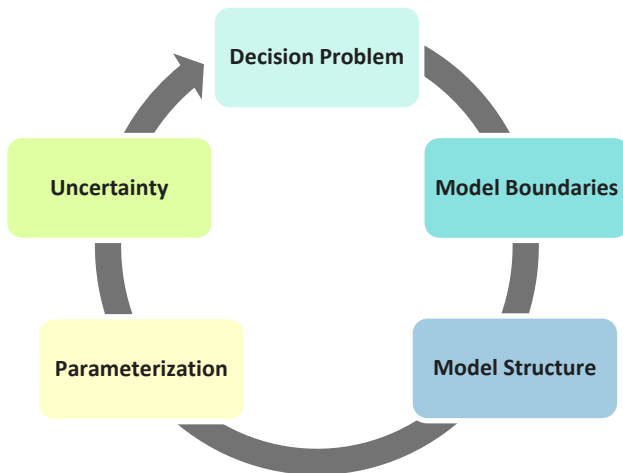
Step 5: Uncertainty

Uncertainty is present in all economic evaluations

- Apply appropriate methods to quantify the degree of uncertainty
- Probabilistic models addressing *parameter & decision* uncertainty

Decision analytic modeling in HTA

Use the modelling infrastructure to conduct additional analyses:



- What is the budget impact of adopting this new technology?
- Is it cost-effective to invest in more research given the specific policy question under evaluation?

Evidence synthesis for economic model

- The quality of evidence that goes into the model can have a profound effect on the output of the model



Important consideration for evidence

- The care pathway
 - The care pathway is useful to map out the journey of the patients and identify important outcomes that would change the trajectory of the patients.
- Type of outcomes
 - Prediction capability (e.g. Clinical outcomes vs. Surrogate outcomes)
 - Duration of observation (e.g. KM curve extrapolation)
- Hierarchy of evidence for main/primary treatment effect
 1. Systematic reviews (AMSTAR-2)
 2. RCTs (Cochrane Risk of bias tool 2.0)
 3. Comparative observational studies (Down and Black checklist, SIGN)
 4. Expert opinions

Overview

- When building an economic model, it's important to consider the quality of evidence that goes into the model
 - GRADE, RoB
- Use care pathway to identify important outcomes along the pathway (e.g. outcomes that can predict future events which changes the trajectory of the patients)
- Plan the economic analysis according to the quality of evidence and RoB
- Use risk of bias assessment to plan sensitivity analysis of the model

Reviewing economic models

- Consideration of data inputs, model structure and both internal and external consistency

****Note: CHEERS checklist is *not* a critical appraisal tool only a reporting guideline**

REVIEW ARTICLE

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Good Practice Guidelines for Decision-Analytic Modelling in Health Technology Assessment A Review and Consolidation of Quality Assessment

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Summary and impact

- Economic modeling is an important part of the HTA process that ideally has a broad set of social and economic criteria
- Modeling can be quite complex and usually requires specialized expertise
- Helpful to work directly with stakeholders early on and have regular check-ins
- Modeling relies on a sound evidence base; timing and project management paramount
- Well designed process can directly impact health system decision-making