Introduction to Decision Analysis Modelling

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Assumptions (always dangerous)

- You’re already familiar with the essential components of a decision analysis
- You’ve been introduced to the basic idea of cost-effectiveness analysis
- You may not be comfortable with a decision tree, but you’ve seen a few
- You haven’t programmed any decision trees, or did once upon a time, but……
Objectives

- Define and describe the purpose of decision modelling
- Describe the type of model in pharmacoeconomic
- Discuss issues in decision modelling

Principles of Decision Modelling in Pharmacoeconomic
Principles of Pharmacoeconomic

- Research questions
  - Compared to the standard intervention
    - Is the new intervention effective?
    - Is the new intervention less expensive?
    - Is the new intervention cost-effective?
    - Is the new intervention cost-saving?

How Do We Get PEc Evidence?
Economic evaluation piggyback vs modelling

<table>
<thead>
<tr>
<th>COST</th>
<th>EFFECTIVENESS</th>
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<tr>
<td><strong>Trial based/Piggyback</strong></td>
<td><strong>Modelling</strong></td>
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<tr>
<td>- Perform economic evaluation alongside a clinical/epidemiology study</td>
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<td>- Use discounted areas between curves (KM, cumulative cost curves)</td>
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<td>- Problem – intermediate endpoints, short time horizon</td>
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<td>- Combines data from different sources</td>
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<td>- Possible to estimate final endpoints, lifelong time horizon</td>
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<td>- Problem: have to make assumptions about effect beyond clinical trial time horizon</td>
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Average Cost A – Average Cost B
Average Effectiveness A – Average Effectiveness B
Definition of Decision Modelling/Analysis

- Is a systematic, explicit and quantitative approach for decision making under uncertainty
- Origin since landmark Weinstein (1977) published

Decision Analysis: The Premise
What are the Health Consequences of HIV Treatment?

Clinical Research  Economic evaluation research

- Intervention
- Intermediate outcome
- Final outcome

y0  Intervention time  Lifetime

CD4+  Viral Load  Opportunistic Illness  Survival  QALY

What would be the outcomes expected from obesity prevention program?

Health promotion research  Economic evaluation research

- Implementation health program
- Intermediate outcome
- Final outcome

y0  Intervention time  Lifetime

Knowledge, Attitude & Practice  Weight reduction
Why Model?

• To **predict** the health outcome and monetary consequences of an intervention
  – Beyond the scope of available evidence
  – When interventions cannot be evaluated directly
• To **explore** beyond the results of a trial
• To **link** intermediate clinical endpoints to final outcomes
• To **generalise** to other settings
• To **synthesize** head-to-head comparisons where relevant trials do not exist
• To **inform** decisions in the absence of data

Rationale for Models: Contrasting Paradigms

**MEASUREMENT**
• Testing hypotheses about individual parameters
• Relatively few parameters of interest
• Primary role for trials
• Focus on parameter uncertainty

**DECISION MAKING**
• What do we do now based on all sources of current knowledge?
• Decisions cannot be avoided
• A decision is always taken under conditions of uncertainty
• Decision making involves synthesis
• Can be based on implicit or explicit analysis
An Analytical Framework for Decision Making

• When is a technology cost-effective?
  – Includes all relevant comparisons
  – A consistent perspective on costs
  – A clear objective (e.g. maximise health gain)
  – A single ‘generic’ measure of outcome (e.g. QALYs)
  – Incorporates all relevant evidence but reflects its imperfections
  – Includes trials and non-trial evidence

• When is additional research cost-effective?
  – Explicit quantification of uncertainty in adoption decision
  – Quantification of the cost of making the wrong decision
  – Compare the cost of new research with the value of additional information

Stages of Developing Decision Model
Decision Analysis: Basics

Step 1: **FRAME** the question [*crucial, but usually straightforward]*
Step 2: **STRUCTURE** the clinical problem [*crucial, easy to get wrong]*
Step 3: Estimate the **PROBABILITIES** [*tedious]*
Step 4: Estimate the **VALUES** of the outcomes [*tedious]*
Step 5: **ANALYZE** the tree (average out/fold back) [*easy]*
Step 6: **TEST ASSUMPTIONS** (sensitivity analysis) [*fun]*
Step 7: **INTERPRET** the results [*hard!*]

Concerns About Modelling

- Black box
- Inappropriate use of clinical data
- Biases in observational data
- Difficulties of extrapolation
Good Economic Modelling Practice

- Keep it simple
- Keep it transparent
- Keep data quality explicit
- Keep a focus on uncertainty
- Compare results to others
- Consensus guidelines

THE END
References

