INTRODUCTION TO HEALTH ECONOMICS:
DECISION ANALYSIS

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Decision analysis

- uses the principles of *health economics* and *cost-effectiveness analysis*
- to differentiate between *competing interventions*
- to identify those that are *good value for money*
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Introduction to health economics: Types of analyses

- Cost Effectiveness Analysis ***
- Cost Utility Analysis ***
- Cost of Illness
- Cost Benefit Analysis
- Cost Minimization Analysis
- Budget Impact Analysis

Don’t worry about these today
Cost effectiveness principles:
What is cost effectiveness analysis?

Evaluation of the balance between additional health benefits and the additional costs of achieving those benefits
Cost effectiveness principles:
What is cost effectiveness analysis?

Evaluation of the balance between additional health benefits and the additional costs of achieving those benefits
• New interventions offer potential benefits, but often have added costs

• Payers are increasingly concerned about expanding healthcare and pharmaceutical budgets

• Perceived increased costs may represent a barrier to implementation of interventions

• Payers need to identify interventions that offer the best value for money

• Making resource allocation decision under conditions of scarcity

Cost effectiveness principles: Why cost effectiveness analysis?
ICER allows comparison of costs and effects across interventions

\[
\text{ICER} = \frac{\text{Total Costs (new intervention)} - \text{Total Costs (existing intervention)}}{\text{Effect (new intervention)} - \text{Effect (existing intervention)}}
\]
Cost effectiveness analysis: The cost effectiveness plane (1)

Identify quadrant in which a new intervention falls

- More Effective
- Less Effective
- Lower costs
- Additional costs

- Dominant
- Questionable
- Excluded

Added expenses outweigh clinical benefits

Good value for money

Current Standard Treatment

Threshold barrier:
AUD 76,000
USD 50,000
GBP 30,000
3 x per capita GDP

Current Standard Treatment

Added expenses outweigh clinical benefits

Good value for money
Cost effectiveness analysis: The cost effectiveness plane (2)

- Rosiglitazone vs. Pioglitazone type 2 diabetes
- Current Standard Treatment
- Less Effective
- Excluded
- Additional costs
- Added expenses outweigh clinical benefits
- More Effective
- Dominant
- Lower costs
- Good value for money
- Interferon therapy for Multiple sclerosis
- Intensive vs. Conventional Insulin Type 1 diabetes
- ACE-I/ARBs treatment of MA/GPR in hypertensive type 2 diabetes
- Questionable
- Added expenses outweigh clinical benefits

- Intensive vs. Conventional Insulin Type 1 diabetes
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• What is disease modeling?

• “…mathematical representation of the course of a disease and effects of interventions on progression of disease. Costs may or may not be included.”

• Many different types of model
  – Simple decision trees
  – Markov models
  – Semi-Markov
  – Monte Carlo simulation
  – Discrete event simulation etc.
Reasons for modeling (1)

• Time frame
  – short-term clinical trials
  – narrow “time slice” of disease and/or complication development

• Surrogate (intermediate) endpoints often measured in trials
  – Blood glucose, blood pressure, body weight etc

• Reimbursement decisions are based on other endpoints
  – E.g. Quality-adjusted life years gained
Reasons for modeling (2)

• Analysis of costs

  – Most clinical trials do not include cost outcomes

  – Need to translate changes in intermediate outcomes into long term costs

  – Adding price tags to interventions and events/complications

  – Country-specific adaptations - How do these results translate to my country setting?
• Required by decision makers

  – Australia, Canada, Sweden, Finland, Germany, France

  – US Managed Care Guidelines

  – National Institute for Clinical Excellence (UK)

  – And an increasing number of additional countries worldwide…
• “What if” analyses

• Allows exploration of the impact changing key clinical or cost variables
  – Identify key clinical factors
  – Identify key cost factors
  – Break even analysis
  – Risk/benefit thresholds
  • e.g. for a given decrease in HbA1c, what incidence of acute pancreatitis will wipe out any gains

• Can be a useful tool in guiding further research
Some interventions may seem costly in the short term

BUT

Are cost-effective in the long-term

– Because they reduce the development of long-term complications and their associated costs
Transitions to NGT and T2 are treatment-dependent

Mortality rates are state dependent (AusDiab Report)

NGT: 2-hour BG<7.8 mmol/L; IGT 7.8-11.0; T2D ≥ 11.1
Simple decision analysis model structure example (2)
• Simulates disease progression and the complications of diabetes based on a series of sub-models
  - Renal disease
  - Eye disease
  - Cardiovascular disease
  - Neuropathy
  - Diabetic foot
• Computer simulation model designed to...

  – Take surrogate end-points and translate them into long-term health economic end-points

  – Assign country-specific unit costs, thereby allowing country-specific health economic analyses
• 18 inter-dependent sub-models – simulate the complications of diabetes

• Individual patient-level Markov-like simulation

• First and second order Monte Carlo simulation
  – to take into account statistical uncertainty around patient pathways in input parameters
CORE Diabetes Model:

User sets simulation conditions
Generate baseline population
Any patients to run?

Time horizon Reached?

Stop

ACEI treatment
Statin treatment
Aspirin treatment

PII Angina CHF Stroke PVD Neuro-mortality Retinopathy Macular edema Cataract Retinopathy Hypoglycemia Ketoacidosis Lactic acidosis Non-specific mortality

Screening LASER treatment

Overall annual survival
Time counter advances
Update simulation data
Overall conclusion

The Fourth Hurdle........

“Demonstrating ............ a product's safety, efficacy, and quality (the first three hurdles) are no longer sufficient.

Manufacturers must now demonstrate cost-effectiveness - is the product good value for money?”

Fourth hurdle reviews, NICE, and database applications.
John E. Paul, PhD, Paul Trueman.
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If you are interested in further learning....

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