Appropriate model time horizons

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Appropriate model time horizons: Empirical results

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Objectives

- Determine the impact of model time horizon on the results from health economic models in a variety of disease areas
- Explore the implementation of a lifetime horizon, and how sensitive model results are to this setting

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Models considered

- Models constructed in the following disease areas were considered:
  - Oncology
    - Standard chemotherapy treatment
    - Immunotherapy treatment
  - Rheumatology
    - Treatment for cartilage damage
  - Infectious disease
    - Vaccination
  - Gastroenterology
    - Constipation
  - Pulmonology
    - Lung disease
  - Endocrinology
    - Metabolic disorder
  - Neurology
    - Storage disorder

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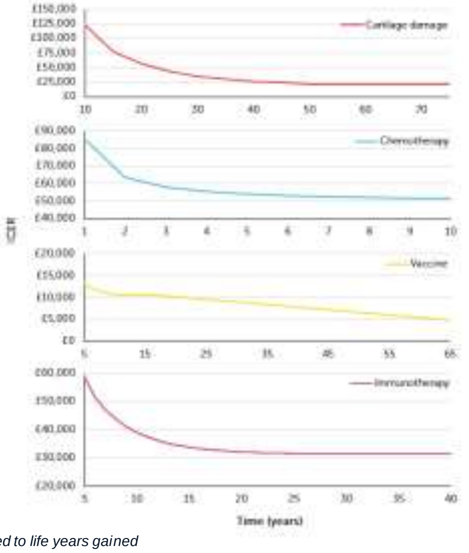
Impact of time horizon on model results

- To determine the impact of the time horizon on model results, analyses varied the time horizon in each model and recording the incremental cost-effectiveness ratio (ICER).
  - Example results are plotted in the figures to the right where the ICER began to stabilise.
- In many cases, a lifetime horizon is required in modelling as, typically, we wish to consider the impact a treatment may have on a patient from initiation until death.
  - Therefore, we must ask:
    "How do we model a lifetime horizon?"



The vaccination model was not considered in this analysis as the model considers life years lost as opposed to life years gained

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Available guidance

- Available guidelines give limited detail regarding lifetime horizon application:
  - ISPOR Good Research Practices Task Force (2012)

  "The time horizon of the model should be long enough to capture relevant differences in outcomes across strategies. A lifetime horizon may be required."

  - NICE Guide to the methods of technology appraisal (2013)

  "Many technologies have impacts on costs and outcomes over a patient's lifetime. In such instances, a lifetime time horizon for clinical and cost effectiveness is usually appropriate. A lifetime time horizon is required when alternative technologies lead to differences in survival or benefits that persist for the remainder of a person's life."

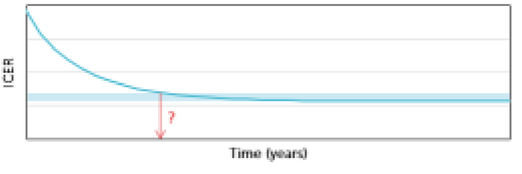
  - Briggs et al. (2006)

  "For decision making, economic evaluation requires that studies adopt a time horizon that is sufficiently long to reflect all the key differences between options in terms of costs and effects. For many interventions, this will effectively require a lifetime time horizon… Economic evaluations based on a single source of patient-level data (e.g. a randomised trial or observational study) will rarely have follow-up which is sufficiently long to facilitate a lifetime time horizon."

Full reference list at back of presentation

Analyses considered regarding lifetime horizon

- To assess how alternative definitions of a "lifetime" horizon impact model results, the following scenarios were considered:
  - 99% of patients dead – the majority of patients have died
  - 99.5% of patients dead – 100% (to 0 decimal places) of patients have died
  - Longest time horizon available in each model – the closest estimate of 100% of patients
  - Proportion of deaths required to model such that the ICER produced is sufficiently different to the ICER produced using the longest time horizon available – in this presentation, a difference of 10% in the ICER



Impact of lifetime horizon on model results

Model	Proportion of patients dead		Maximum time horizon	ICER changed by 10%	
	99%	99.5%		Patients dead	Time horizon
Chemotherapy	£53,294	(-£1,217; -2.3%)	(-£1,705; -3.2%)	97%	3 years (maximum: 10 years)
Immunotherapy	£31,504	(-£26; <0.1%)	(-£23; <0.1%)	92%	14 years (maximum: 40 years)
Lung disease	£32,443	(-£61; <0.1%)	(-£82; <0.1%)	89%	16 years (maximum: 34 years)
Metabolic disorder	£925,735	(-£80; <0.1%)	(-£127; <0.1%)	72%	44 years (maximum: 100 years)
Cartilage damage	£21,252	(-£8; <0.1%)	(-£8; <0.1%)	40%	47 years (maximum: 75 years)
Storage disorder	£112,124	(-£25; <0.1%)	(-£25; <0.1%)	N/A	N/A (maximum: 56 years)
Constipation	N/A	N/A	£29,117	N/A	N/A (maximum: 21 years)

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Conclusions

- The implementation of a lifetime horizon in models where technologies have an impact on the costs incurred and outcomes accrued over a patient's lifetime appears appropriate, based on these results.
- In models driven by survival, modelling at least 99% of deaths may be considered reflective of a lifetime horizon.
- In some models, a much shorter time horizon may be appropriate:
  - In the cartilage damage model, the ICER only changed by 10% when 40% of patients had died.
  - In the constipation model, the ICER never changed by 10%.

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Thank you

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References

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National Institute for Health and Care Excellence (NICE). Guide to the methods of technology appraisal 2013. Published: 4 April 2013. Available at: www.nice.org.uk/process/pmg9. Accessed: October 2016.

Briggs AH, Sculpher M and Claxton K. Decision Modelling for Health Economic Evaluation (Handbooks for Health Economic Evaluation). Oxford University Press, 2006.

Time Horizons in Models:
A Decision-Maker's Perspective

Matthew Taylor

Summary

- Decision-making
- Accounting for uncertainty
- Differentiating between effects and consequences
- Barriers and incentives to uptake

Decision-making

- All models are wrong, etc.
- ICERs from models are one single factor in the process
- What is the question that we're asking?

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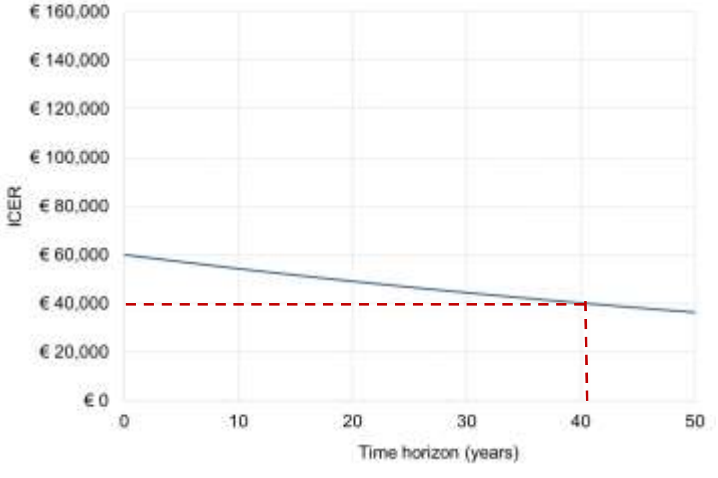
ICERs over time



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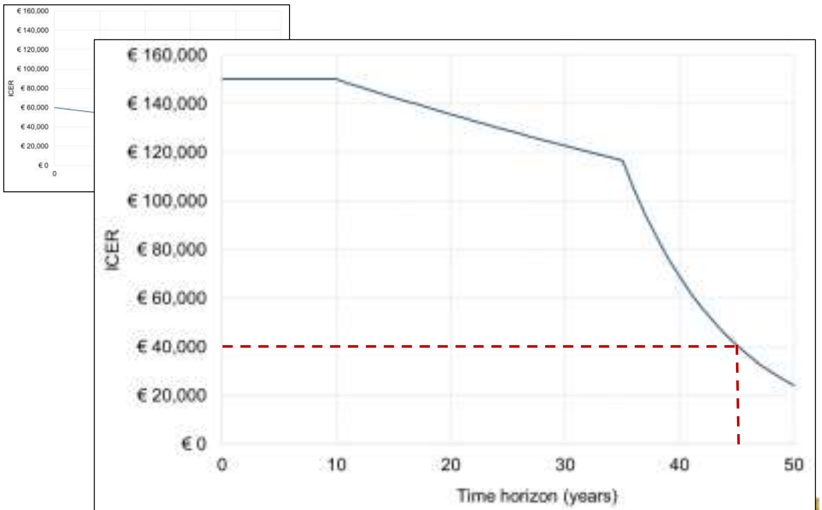
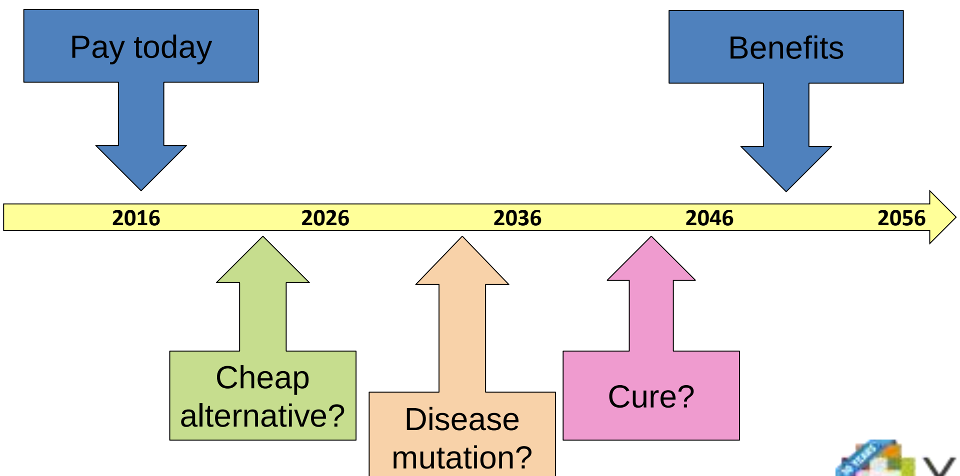
ICERs over time



Now… and then



Reflecting uncertainty

- Never really captured in sensitivity analysis (deterministic or probabilistic)
- Discount rates?
- But… these are consistent across all therapeutic areas
- Greater uncertainty → higher discount rates?
- What will the value of λ be in 40 years' time???

Effects and consequences

- Extrapolating the effectiveness of therapies introduces substantial uncertainty
  - Not always adequately captured through sensitivity analysis (very mathematical in approach)
- The *consequences* of an effect are usually more certain – and will often be long-term
  - e.g. a death averted in the short-run will have long-term consequences on QALYs
- Sometimes, effects and costs are constant

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Barriers to uptake

- Even when intervention are cost-effective in the long-run, uptake is slow (or non-existent)
- Incentives to local decision-makers
- Short-term budget goals
- Being transparent about results at different time points can help this discussion

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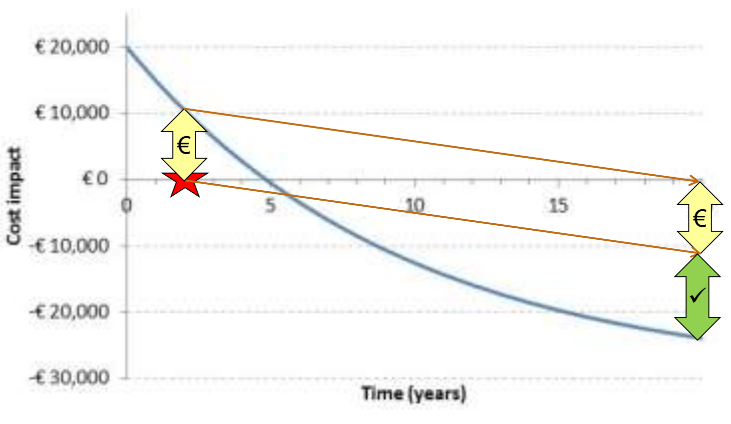
Barriers to uptake



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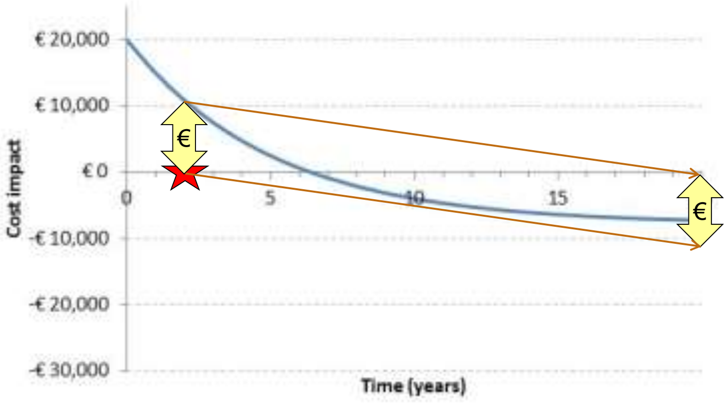
Barriers to uptake



Summary again

- Decision-making
- Accounting for uncertainty
- Differentiating between effects and consequences
- Barriers and incentives to uptake

Thank you

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