

Cost Effectiveness Modelling for Health Technology Assessment

A 5-day practical course

28 April – 02 May 2025 | Edinburgh

Programme



Cost Effectiveness Modelling for Health Technology Assessment

Faculty



Prof. Peter Hall
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Note on Presenters:

A Main Presenter delivers each Session with the assistance of another member of the Faculty. The Sessions are delivered as either a lecture, or a lecture with applied exercises to be completed and discussed during the session. Each day of the course is made of four sessions, with the exception of the first day, which starts in the afternoon and consists of two sessions.



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Learning Objectives

- Understand the concepts and rationale of HTA and types of economic evaluation
- Understand when you would use a decision tree model and how they work
- Understand when you would use a Markov model, how they work and how to use them to inform decision making
- Appreciate the importance of uncertainty in economic evaluations and how this can be assessed
- Be able to generate a probabilistic Markov model in Excel and produce and interpret outputs
- Understand the concept of value of information and calculate this from probabilistic model results
- Learn about key developments and debates in HTA including precision medicine, real-world evidence and the willingness to pay threshold



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Course Schedule

Day 1: Monday 28 April 2025

12:00 – 13:00	<i>Registration and Lunch</i>	
13:00 – 14:15	Session 1: Introduction to HTA and Economic Evaluations	Peter Hall and David Meads
14:15 – 14:30	<i>Tea & Coffee</i>	
14:30 – 15:45	Session 2: Economic Evaluations (inc. trial-based)	David Meads and Peter Hall

Day 2: Tuesday 29 April 2025

09:00 – 09:30	<i>Registration and coffee</i>	
09:30 – 10:45	Session 3: Decision Model-based Economic Evaluations	David Meads and Alison Smith
10:45 – 11:00	<i>Tea & Coffee</i>	
11:00 – 12:15	Session 4: Decision-Analytic Models – Decision Tree Models	Alison Smith and David Meads
12:15 – 13:15	<i>Lunch</i>	
13:15 – 14:30	Session 5: Decision-Analytic Models – Considerations in Diagnostics	Alison Smith and David Meads
14:30 – 14:45	<i>Tea & Coffee</i>	
14:45 – 16:00	Session 6: Decision Tree Models – Sensitivity Analysis	David Meads and Alison Smith



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Day 3: Wednesday 30 April 2025

09:00 – 09:30	<i>Registration and coffee</i>	
09:30 – 10:45	Session 7: Decision-Analytic Models – Markov Models 1	David Meads and Daniel Howdon
10:45 – 11:00	<i>Tea & Coffee</i>	
11:00 – 12:15	Session 8: Decision-Analytic Models – Markov Models 2	Daniel Howdon and David Meads
12:15 – 13:15	<i>Lunch</i>	
13:15 – 14:30	Session 9: Markov Models – Probabilistic Sensitivity Analysis 1	Giovanni Tramonti and Daniel Howdon
14:30 – 14:45	<i>Tea & Coffee</i>	
14:45 – 16:00	Session 10: Markov Models – Probabilistic Sensitivity Analysis 2	David Meads and Giovanni Tramonti



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Day 4: Thursday 01 May 2025

09:00 – 09:30	<i>Registration and coffee</i>	
09:30 – 10:45	Session 11: Markov Models – Probabilistic Sensitivity Analysis 3	David Meads and Daniel Howdon
10:45 – 11:00	<i>Tea & Coffee</i>	
11:00 – 12:15	Session 12: Decision Uncertainty	Giovanni Tramonti and Daniel Howdon
12:15 – 13:15	<i>Lunch</i>	
13:15 – 14:30	Session 13: Introduction to Modelling in R	Giovanni Tramonti and Daniel Howdon
14:30 – 14:45	<i>Tea & Coffee</i>	
14:45 – 16:00	Session 14: Use of Real-World Evidence for decision-making 1	Daniel Howdon and Giovanni Tramonti



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Day 5: Friday 02 May 2025

09:00 – 09:30	<i>Registration and coffee</i>	
09:30 – 10:45	Session 15: Use of Real-World Evidence for decision-making 2	Daniel Howdon and Giovanni Tramonti
10:45 – 11:00	<i>Tea & Coffee</i>	
11:00 – 12:15	Session 16: Use of Real-World Evidence for decision-making 3	Daniel Howdon and Giovanni Tramonti
12:15 – 13:15	<i>Lunch</i>	
13:15 – 14:30	Session 17: Current methodological debate in HTA	Daniel Howdon, Peter Hall, and Giovanni Tramonti
14:30 – 14:45	<i>Tea & Coffee</i>	
14:45 – 16:00	Session 18: Current methodological debate in HTA	Daniel Howdon, Peter Hall, and Giovanni Tramonti



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Session Details

Session 1: Introduction to HTA and Economic Evaluations

In this introductory session, participants will gain a fundamental understanding of Health Technology Assessment (HTA) and its role in healthcare decision-making. They will learn about the global context of HTA and how it varies across different healthcare systems. The session will explore the reference case of the National Institute of Health and Care Excellence (NICE) as a prominent example of HTA. Concepts of reimbursement and cost-effectiveness thresholds will be explored, helping participants grasp the criteria that guide decisions on whether to fund specific healthcare technologies.

Session 2: Economic Evaluations (inc. trial-based)

This session will expand on the various types of economic evaluations commonly used in HTA, such as cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis. Participants will learn how costs and outcomes are measured, with the consideration of different perspectives, and also the fundamentals of clinical trials, with an emphasis on their importance in economic evaluation.

Session 3: Decision Model-based Economic Evaluations

The session covers decision model-based economic evaluations, providing insights into when and why these models are used. Detailed discussions will cover the data requirements, output generation, and the various types of models available. Decision models play a critical role in extrapolating outcomes beyond the duration of clinical trials, and this session will clarify their importance. The session will include brief MS Excel training exercises.

Session 4: Decision-Analytic Models – Decision Tree Models

This session will provide an in-depth exploration of designing decision tree models within the context of healthcare decision-making. Using a diagnostic technology case study, participants will learn how to construct and populate decision tree models. This type of models is among the most common in the field, and serve as invaluable tools for mapping out numerous healthcare scenarios, guiding the decision-making process by depicting various possible pathways, probabilities, and associated outcomes.

Session 5: Decision-Analytic Models – Considerations in Diagnostics

In this session, several diagnostic considerations in decision-analytic models will be explored, with a focus on topics such as overdiagnosis, sensitivity and specificity, and the accuracy of diagnostic tests. The potential for overdiagnosis and its impact on healthcare decision-making will be examined and the concepts of sensitivity and specificity will be elaborated upon, emphasizing their role in the evaluation of diagnostic test performance. Furthermore, the process of adding a new clinical pathway to routine patient care will be discussed, providing practical insights into how the effects of diagnostic technologies on patient management strategies can be accounted for.

Session 6: Decision Tree Models – Sensitivity Analysis

This session will focus on the techniques of one-way sensitivity analysis and headroom analysis. Participants will learn how to systematically explore the impact of varying key parameters or assumptions on the outcomes within their decision trees. One-way sensitivity analysis allows for the identification of the most influential factors affecting the model's results, enabling decision-makers to understand the model's robustness. Additionally, headroom analysis will be covered, helping



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participants assess the financial feasibility of new interventions and pinpointing the range of costs within which a healthcare technology becomes cost-effective.

Session 8: Decision-Analytic Models – Markov Models 1

In this session, participants will be introduced to Markov models, understanding when and why these models are essential in healthcare decision-making. With a focus on practical application, the session will guide students through the design and setup of Markov models, emphasizing the construction of transition matrices and the computation of traces. The concept of probabilistic sensitivity analysis (PSA) will also be introduced, enabling participants to explore the influence of uncertainty on model outcomes.

Session 9: Decision-Analytic Models – Markov Models 2

In this session, participants will be introduced to Markov models, understanding when and why these models are essential in healthcare decision-making. With a focus on practical application, the session will guide students through the design and setup of Markov models, emphasizing the construction of transition matrices and the computation of traces. The concept of probabilistic sensitivity analysis (PSA) will also be introduced, enabling participants to explore the influence of uncertainty on model outcomes.

Session 9: Markov Models – Probabilistic Sensitivity Analysis 1

In this focused session, participants will learn setting up Probabilistic Sensitivity Analysis (PSA) in healthcare decision modelling, with a specific emphasis on selecting parameters related to effectiveness and survival. Participants will learn how to incorporate uncertainty surrounding key effectiveness and survival parameters into their models, enabling a more comprehensive exploration of the impact of these uncertainties on the model's results.

Session 10: Markov Models – Probabilistic Sensitivity Analysis 2

Building on the previous one, this session will expand on the setup of the probabilistic sensitivity analysis by examining how to choose and use parameters relating to cost and utility. By the end of the session, attendees will have the practical skills and knowledge needed to correctly setup a PSA, contributing to a deeper understanding of the robustness and reliability of healthcare decision models when confronted with uncertainties in cost and utility estimations. Attendees will explore the diverse range of outputs generated by PSA, providing insights into the distribution of results and their implications for decision-making. The session will address common challenges in PSA, such as interpreting scatterplots and calculating Incremental Cost-Effectiveness Ratios (ICERs).

Session 11: Markov Models – Probabilistic Sensitivity Analysis 3

This session will focus on additional topics relating to PSA outputs, such as Lambda values and Cost-Effectiveness Acceptability Curves. Attendees will learn how to implement and interpret Lambda values. The session will provide a comprehensive understanding of Cost-Effectiveness Acceptability Curves, enabling participants to assess the likelihood of a healthcare intervention being cost-effective across varying willingness-to-pay thresholds. Additionally, participants will explore the concept of Acceptability Frontiers, which helps decision-makers identify the range of scenarios where interventions are likely to be cost-effective.



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Session 12: Decision Uncertainty

This session will address the importance of decision uncertainty in HTA. Participants will explore the potential costs associated with making incorrect decisions and the concept of Value of Information (VOI). Specific VOI components, such as Expected Value of Perfect Information (EVPI), Expected Value of Partial Perfect Information (EVPPI), and Expected Value of Sample Information (EVS), will be discussed, highlighting their role in decision-making under uncertainty.

Session 13: Introduction to Modelling in R

This session will introduce participants to the use of R Programming Language for modelling in HTA. Participants will learn the basics of using R for modelling purposes, gaining practical skills to apply in their HTA work. The session will cover the advantages and disadvantages of using R for economic evaluations, and it will present useful resources and packages to adapt the model used throughout the course as an example from MS Excel to R.

Session 14: Use of Real-World Evidence for decision-making

Following the information provided in sessions 12 and 13, analytical approaches for incorporating RWE into HTA will be explored through case studies and practical examples, emphasizing its growing relevance in evidence-based decision-making.

Session 15: Use of Real-World Evidence for decision-making

This session is a continuation of session 14, with additional examples and exercises relating to the use of RWE in HTA.

Session 16: Use of Real-World Evidence for decision-making

This session is a continuation of session 14 & 15.

Session 17: Current methodological debate in HTA

The final two sessions will engage participants in a discussion of ongoing methodological debates within the field of HTA. Topics will include cost-effectiveness thresholds, opportunity cost and budget considerations, spillover effects of healthcare interventions, and the balance between equity and efficiency in healthcare decision-making. Participants will learn of the evolving landscape of HTA methodology and the challenges facing decision-makers in today's healthcare systems.

Session 18: Current methodological debate in HTA

This session is a continuation of session 17.



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