(GMS5224) Advanced Health Technology Assessment Methods
Meeting time: Weekly from 6:00 – 9:00 pm SGT
Meeting Location: Zoom

Instructors: Junxing Chay PhD (Primary), Eric Finkelstein PhD

Synopsis of Course Content
Building on key concepts introduced in the introductory course, this course moves students from modelling in Microsoft Excel, which is helpful to ensure a basic understanding of cost-effectiveness analysis, to modelling in TreeAge Pro. TreeAge Pro is a specialized software that offers a range of built-in functions for more sophisticated models. Using real-world examples, we will introduce students to advanced modelling strategies. Some lectures are structured as a flipped classroom. Students are expected to prepare for flipped classes by watching pre-recorded tutorials, reading assigned papers and via other materials as would be provided in a classical lecture. During class, students will deepen their understanding of the material by problem-solving, presenting findings and via other interactive learning approaches.

Prerequisites
Introduction to Health Economic Modelling (Duke-NUS GMS5222) or equivalent

Textbooks
Weekly readings (textbook chapters and published articles) are provided under each lecture.

Software
TreeAge Pro

Performance Assessment
Performance will be assessed on i) individual in-class quizzes; ii) assignments; iii) in-class hackathons; and iv) a final assessment. Assignments 1 and 2 and the Hackathon II are completed in groups of 4-5 students.

Grade Breakdown

Component	Weightage (%)	Assessment Due Date
Weekly in-class quizzes	30% (Excluding the two lowest scores)	N/A
Assignment 1	10%	Week 6
Assignment 2	10%	Week 10
In-class Hackathon I and II	20%	Week 6 and 12
Final Assessment	30%	Week 13

Course Outline

Week	Lecture
1	Key Considerations for HTA and Refresher on Cost-Effectiveness Models
2	Decision Trees
3	Markov Models
4	Sensitivity Analysis
5	Markov Model Extensions
6	Hackathon I: Markov Model
7	Microsimulation I
8	Microsimulation II
9	Microsimulation III
10	Special Topic: Distributional Cost-Effectiveness Analysis (tentative)
11	Budget Impact Analysis
12	Hackathon II: Microsimulation

13	Final Assessment

Week 1: Considerations for HTA and Refresher on Cost-Effectiveness Models

Class Outline:

I. Review of key learnings from semester 1
II. Review of cost-effectiveness analysis
III. Building decision trees and Markov models
IV. Sensitivity analyses
V. Market/budget impact analysis

Reading List:

- Finkelstein, E. A., Krishnan, A., & Doble, B. (2020). Beyond cost-effectiveness: A five-step framework for appraising the value of health technologies in Asia-Pacific. The International Journal of Health Planning and Management, 35(1), 397-408.
- Gray et al., Applied methods of cost-effectiveness analysis in healthcare.
- Drummond et al., Methods for the Economic Evaluation of Health Care Programmes, 4th Ed. Oxford University Press.

Week 2: Decision Trees

Class Outline:

I. Introduction to TreeAge Pro
II. How to build and analyse decision trees with TreeAge Pro
III. Review of CEA for multiple interventions

Students should watch and practice along with the pre-recorded tutorial before class. During class, students will work in groups to complete a modelling exercise.

Reading List:

- Pre-recorded tutorial

Assignment:

- Assignment 1 will require students to work in groups to draft a detailed analysis plan to address questions about the cost-effectiveness of a new healthcare intervention. Students may form their own groups by Week 3, after which they will be randomly assigned. Please submit your assignment before the start of class in Week 6. More information will be provided.

Week 3: Markov Models

Class Outline:

I. How to build and analyse Markov models with TreeAge Pro
II. Understanding the Cohort Details report
III. Cycle corrections
IV. Cloning nodes and variable management
V. Exporting to Excel

Students should watch and practice along with the pre-recorded tutorial before class. During class, students will work in groups to complete a modelling exercise.

Reading List:

- Pre-recorded tutorial

Week 4: Sensitivity Analysis

Class Outline:

I. One-way sensitivity analysis and tornado diagrams

II. Two-way sensitivity analysis
III. Probabilistic sensitivity analysis
IV. Value of information analysis

Reading List:
- Review TreeAge Pro models built in Weeks 2 and 3.

Week 5: Markov Model Extensions
Class Outline:
I. Incorporating events and transitional payoffs
II. Reporting event counts
III. Semi-Markov models
   - Time-in-model dependent probabilities
   - Time-in-state dependent probabilities (tunnel states)

Students should watch and practice along with the pre-recorded tutorial before class. During class, students will work in groups to complete a modelling exercise.

Reading List:
- Pre-recorded tutorial

Week 6: Hackathon I
Class Outline:
In this class, students will replicate, analyse and interpret a Markov model using TreeAge Pro. Students will work in groups but each student is required to submit their own individual work. More information will be provided.

Week 7: Microsimulation I
Class Outline:
I. Parametric and bootstrap sampling for heterogeneity
II. Subgroup analysis
III. Individual patient trackers
IV. Probabilistic sensitivity analysis for microsimulation

Reading List:
- Siebert U, Alagoz O, Bayoumi AM, et al. State-transition modeling: a report of the ISPOR-SMDM Modeling Good Research Practices Task Force--3. *Value Health*. 2012;15(6):812-820.

Assignment:
- Assignment 2 will require students to revise based on feedback on Assignment 1 and expand on their analysis plan. More information will be provided. Please submit your assignment before the start of class in Week 10.

Week 8: Microsimulation II
Class Outline:
During class, students will work in groups to extend an existing Markov model for microsimulation and conduct sensitivity analysis.

Reading List:
- Review Week 5 & 7 materials

Week 9: Microsimulation III
Class Outline:
In this class, students will work in groups to replicate, analyse and interpret a microsimulation model

using TreeAge Pro. More information will be provided.

Reading List:

- Review Week 7 & 8 materials
- [*Essential reading before class*] Hiligsmann M, Ethgen O, Bruyère O, Richy F, Gathon HJ, Reginster JY. Development and validation of a Markov microsimulation model for the economic evaluation of treatments in osteoporosis. Value Health. 2009 Jul-Aug;12(5):687-96.

Week 10: Special Topic: Distributional Cost-Effectiveness Analysis (tentative)

Class Outline:

I. Introduction to DCEA
II. Triage DCEA exercise

Reading List:

- DCEA resource page: https://www.york.ac.uk/che/equity/distributional-cost-effectiveness-analysis/
- Cookson, R, Griffin, S, Norheim OF. and Culyer, AJ. (Eds). (2020). *Distributional cost-effectiveness analysis: quantifying health equity impacts and trade-offs*. Oxford University Press. Chapter 1 (further reading: chapters 4, 8, 9, 13)
- Robson, M., Asaria, M., Cookson, R., Tsuchiya, A., and Ali, S (2017). Eliciting the Level of Health Inequality Aversion in England. *Health Economics*, 26: 1328–1334.
- Cookson, R and Koh, J. (2023). Quantifying Impact on Health Inequality in England: Revised Final Report and Web-Based Calculator. CHE Research Paper 193, Centre for Health Economics, University of York.

Week 11: Budget Impact and Market Analysis

Class Outline:

I. Budget impact analysis (BIA) vs cost-effectiveness analysis (CEA)
II. Six-steps process for BIA
III. Exporting TreeAge Pro model costs for BIA

Reading List:

- Mauskopf, J., Earnshaw, S. R., Brogan, A., Wolowacz, S., & Brodtkorb, T. (2017). Budget-Impact Analysis of Health Care Interventions: A practical guide. Springer International Publishing AG. https://doi.org/10.1007/978-3-319-50482-7
- Mauskopf et al. (2007). Principles of good practice for budget impact analysis: report of the ISPOR Task Force on good research practices—budget impact analysis. *Value in Health*, *10*(5), 336-347.
- Sullivan et al. (2014). Budget impact analysis—principles of good practice: report of the ISPOR 2012 Budget Impact Analysis Good Practice II Task Force. *Value in Health*, *17*(1), 5-14.

Week 12: Hackathon II

Class Outline:

In this class, students will work in groups to build, analyse and interpret a microsimulation model using TreeAge Pro. More information will be provided.

Week 13: Final Assessment

Class Outline:

Students will work individually to conceptualize and implement a decision-analytic model in TreeAge Pro and use it to conduct cost-effectiveness analysis. More information will be provided.