EPIB 676 Section 2: Advanced topics in decision-analytic modeling for health

DRAFT Course syllabus, Winter 2023, McGill University

Course description

Advanced methods used to model health policy decisions and conduct model-based health technology assessment, both theory and technical applications. Methods covered include: Markov and microsimulation models, optimization, Bayesian model calibration and evaluation, probabilistic sensitivity analyses, and value of information analysis. Application areas include: disease screening, prevention, and treatment, prioritization of clinical research, and policies to avert drug overdose deaths.

Learning objectives

By the end of the course, students should be able to:

- Develop decision analytic models to inform health policy and clinical decisions
- Understand and critically appraise published model-based decision analyses
- Create transparent reports of decision analyses that conform to open science principles

Target audience

The course is targeted towards PhD students and advanced Masters students interested in conducting model-based analyses of health policies and health technologies in research. Modeling skills developed in the course will also be useful for some positions in industry and with governmental agencies.

Meetings

Course meetings will be held 10:05am – 11:25pm at 2001 McGill College Ave in room #1203. Attendance is required.

Instructor

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Prerequisites

The ideal preperation of this course would include (1) a course in probability, (2) a course in statistics, (3) a course on cost-effectiveness such as PPHS 528, and (4) some programming experience (we will use R). Students who lack one prerequisite may need to spend extra time on some course components but should be able to succeed in the course. The course is likely not appropriate for students missing two or more prerequisites, particularly if one of the missing prerequisites is programming experience. Please discuss with the instructor if you are unsure whether your background is appropriate.

Readings

There is no textbook for this course. Readings drawn from various sources will be assigned before many class sessions; they will be posted on the course website. Some readings are tutorials with accompanying code, which students should run and analyse before class when indicated. Students should come to class prepared to discuss the readings; failure to do so can result in a reduced score for class engagement.

Laptops and software

Students should bring a personal laptop to every class. Please reach out to the instructor if you do not have a laptop so alternative arrangements can be made. Students should install and configure the necessary software (R, RStudio, git) before the first class [Link to instructions to be added later].

Approach to learning

This course is designed to give student hands-on experience applying course concepts early and often. The course has two distinct phases:

- **Phase 1 (weeks 1-6)** focuses on understanding methods and building programming skills. Class readings will include tutorials accompanied by R code, which students should run on their own computers before class. Lectures will often contain sample code that

students will run on their own laptops during the lecture. Five programming assignments will be assigned to provide further hands-on experience with model development.

- **Phase 2 (weeks 6-13)** focuses on applying decision analytic modeling to inform health policy and clinical practice. Students will be exposed to several published model-based decision analyses, including through guest lectures and by analyzing an existing open sourced modeling study. Students will also develop their own model-based decision analysis through a course project.

Assignments & evaluation

Class engagement (10%)

Students are expected to attend class having complete assigned readings, actively engage in discussions, and follow along with programming examples on their own laptops.

R programming assignments (40%)

A series of programming assignments will provide hands-on experience developing decision analytic models using various methods. For each assignment, students will be given Quarto document that includes questions, instructions, and starter code. Students will answer the questions and complete the code.

0. R setup + basics (not graded)
1. Decision trees, cost-effectiveness (8%)
2. Cohort models (8%)
3. Simulation (8%)
4. Sensitivity analysis and value of information (8%)
5. Calibration (8%)

Open-source modeling study report (12%)

Students will select a published decision-analytic modeling study with open source code (and data, if applicable). Students will need to run the code on their own machine and give a class presentation about the model and analysis.

Course project (38%)

Using methods they learn in lecture and through the problem sets, students will develop a decision-analytic model an use it to inform a decision from health policy or clinical practice. Students are encouraged to analyze a decision problem related to their own research and/or engage with domain experts outside the class when applicable. Students may work alone or in pairs.

1. Proposal (3%)
2. Class presentation (15%)
3. Written report and code (20%)