PH 444: Medical Cost-Effectiveness Analysis Projects
Spring Quarter 2015

Course Instructor:

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Day/Time:Wednesdays 6-9PM
Location: 633 N Saint Clair, 18th Floor, Central Conference Room

I. Course Description
For medical students with specific medical cost-effectiveness or medical decision analysis projects they wish to move towards publication, or for engineering students who wish to aid in the analysis of such projects. Study and application of advanced decision-analytic methods useful in medical decision modeling and cost-effectiveness analyses. Included are the probabilistic theory of hazard rates and modeling of age-dependent mortality; Markov modeling; techniques for multi-way sensitivity analysis such as probabilistic sensitivity analysis and information-value analysis; cost-effectiveness modeling; the use of spreadsheets for Markov models. Medical decision-analytic literature is reviewed and theoretical underpinnings of models are explored.

II. Prerequisites
Introductory probability (not necessarily calculus-based), introductory statistics, Basic Decision Analysis PUB HLTH 431 or equivalent introduction to decision analysis.

III. Course Objectives
After completion of the course, students should be able to do the following:

- **Markov modeling**
  - Construct a Markov chain transition diagram for a medical treatment problem
  - Use data to estimate incidence rates and convert these to transition probabilities
  - Formulate and solve a Markov chain cohort model in a spreadsheet
  - Discuss a published Markov chain analysis (effectiveness or cost-effectiveness) for a medical treatment problem.

- **Hazard rates and age-dependent mortality models**
  - Specify the mathematical relationship between hazard rates, the survival curve, and the survival time probability density
  - Explain superposition and splitting of independent arrival processes
  - Explain the Gompertz model of human mortality
Complex model formulation and solution
- Formulate a factored model of a complex medical cost-effectiveness problem.
- Use cohort decomposition to solve a factored cost-effectiveness model
- Construct a stochastic tree transition diagram for a medical treatment problem.
- Convert a stochastic tree diagram to a discrete-time Markov chain transition diagram.

Probabilistic sensitivity analysis
- Formulate and calculate a probabilistic sensitivity analysis for a medical cost-effectiveness model.
- Discuss a published probabilistic sensitivity analysis for a medical treatment problem.

Cost-effectiveness analysis
- Discuss basic issues underlying cost-effectiveness and cost-benefit analysis
- Discuss a published cost-effectiveness analysis for a medical treatment problem

IV. Teaching Format
- Class meets weekly. Assigned readings and problems are reviewed and discussed. Software is demonstrated on the instructor’s and students’ notebook computers.
- Class location could be the Chicago or Evanston campuses, depending on the balance of students enrolled. For small enrollments (3 or fewer), classes will meet on the Evanston campus.
- Chicago campus place and time: Wednesdays from 6pm to 9pm.
- Office hours: By appointment.

V. Student Evaluation
Students are evaluated based on:
1. Satisfactory discussion of readings and suggested problems.
2. Satisfactory completion or assistance with a medical decision analysis or cost-effectiveness project.

VI. Readings
Required textbook:

Decision Modelling for Health Economic Evaluation
Andrew Briggs, Karl Claxton and Mark Sculpher
Oxford University Press 2006 (paperback)
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Material covered</th>
<th>Reading and homework for the following week</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction&lt;br&gt;Probability, expectation, decision tree rollback</td>
<td>Briggs Ch.1&lt;br&gt;Briggs Ch.2.1-2.3.1&lt;br&gt;‘Ch. 2 Lecture outline.xlsx’</td>
<td>Briggs Ch. 2.3-2.4&lt;br&gt;Read over and start Exercise 2.5&lt;br&gt;Decision tree rollback exercise based on Briggs Box 2.3</td>
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<td>2</td>
<td>Markov cohort models</td>
<td>Briggs Ch. 2.3.2-2.4</td>
<td>Hand in Exercise 2.5&lt;br&gt;Read “Survival Functions and Hazard Rates”&lt;br&gt;Begin Reading Briggs Ch.3</td>
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<tr>
<td>3</td>
<td>Survival functions and hazard rates</td>
<td>“Survival Functions and Hazard Rates”</td>
<td>Exercises 1,2,3,4 from “Survival Functions and Hazard Rates”&lt;br&gt;Read chapter 3 in Briggs et al. Begin Exercise 3.5 and come prepared to discuss it</td>
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<td>4</td>
<td>Nonstationary Markov cohort analysis&lt;br&gt;Bayes’ Rule</td>
<td>Briggs Ch.3&lt;br&gt;‘Bayes rule.pptx’</td>
<td>Read Chapter 4 in Briggs et al., and begin looking at Exercise 4.7&lt;br&gt;Hand in your attempt at Exercise 3.5, with the following changes&lt;br&gt;Hand in your attempt at the Bayes rule exercise in the Assignments section of this web site</td>
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<td>5-6</td>
<td>Discussion of application of these tools to desired medical decision projects</td>
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<td>Optional exercises and discussion involving student projects.</td>
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<td>7-8</td>
<td>Making a decision model probabilistic</td>
<td>Briggs Ch. 4.1-4.4.1, 4.9&lt;br&gt;‘Toy Problem.xls’</td>
<td>Read Briggs Ch. 4.1-4.4.1, 4.9&lt;br&gt;Upload your solution to the assignment Toy Problem Exercise</td>
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<td>8-9</td>
<td>Analyzing and presenting simulation output</td>
<td>'Exercise 5.7 Instructions wo macros.doc'</td>
<td>Read sections 5.1 - 5.4 in Briggs. We will discuss these sections and also will go over Exercise 5.7 in class</td>
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<td>9-10</td>
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<td>Complete and electronically hand in Exercise 5.7 in Briggs, (not using the macro approach in Briggs)&lt;br&gt;Begin reading Ch 6 in Briggs&lt;br&gt;Read the document &quot;How to Use Hypothesis Testing to Kill Patients”&lt;br&gt;Hand in EVPI for Toy Problem 2</td>
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<td>Finals</td>
<td>Present final project</td>
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**Schedule of lectures**
Academic integrity

Every Northwestern faculty member and student belongs to a community of scholars where academic integrity is a fundamental commitment. The Program in Public Health abides by the standards of academic conduct, procedures, and sanctions as set forth by The Graduate School at Northwestern University. Students and faculty are responsible for knowledge of the information provided by The Graduate School on their Web page at http://www.tgs.northwestern.edu/academics/academic-services/integrity/index.html

Academic misconduct includes, but is not limited to:

1. Receiving or giving unauthorized aid on examinations or homework
2. Plagiarism
3. Fabrication
4. Falsification or manipulation of academic records
5. Aiding or abetting any of the above

The PPH follows The Graduate School’s procedure for evaluating alleged academic misconduct, as outlined on the TGS website. http://www.tgs.northwestern.edu/academics/academic-services/integrity/dishonesty/index.html

Faculty reserve the right to use the “Safe Assignment: Plagiarism Detection Tool” that is part of the Course Management System to evaluate student assignments. Information about this tool can be found at http://www.it.northwestern.edu/education/course-management/support/assessments/safeassignment.html

Course evaluation

The MPH Program administers web-based course evaluations to students for each course near the end of the quarter. Your completion of both the unit (course) and faculty evaluation components is required; failure to complete either of the evaluations will result in an incomplete grade until the evaluations are submitted. You will be sent the web link and instructions via email later in the quarter. You will have about two weeks to complete the evaluations before grades are submitted.