

Modeling for Health Policy and Medical Decision Making

Time and Location: M/W 3:30-4:50pm, KAP 141

Instructor: Sze-chuan Suen (ssuen@usc.edu)

Office hours: W 1:00-3:00, OHE 310N

Number of units: 2-4 units

Goal: The goal of the course is to provide masters and PhD level students with an overview of modeling frameworks and techniques in healthcare decision making. This will equip students to pursue research projects using operations research methods and modeling in their own areas of specialization.

Prerequisites: Basic preparation in probability and stochastic processes, and some experience in software for modeling (Matlab, R, C++, python, VBA, etc.). Advanced undergraduates should obtain instructor permission.

Readings: All required readings should be read in advance of the session in which they are discussed.

Textbooks (optional): There are no required textbooks. Some good reference books are:

1. Margaret L. Brandeau, Francois Sainfort, William P. Pierskalla (Editors). Operations Research and Health Care: A Handbook of Methods and Applications (International Series in Operations Research & Management Science). Springer; 2004.
2. Brian T. Denton (Editor). Handbook of Healthcare Operations Management: Methods and Applications (International Series in Operations Research & Management Science). Springer; 2013.
3. Yasar A. Ozcan. Quantitative Methods in Health Care Management: Techniques and Applications. Jossey-Bass, 2 edition, 2009.
4. Michael Drummond and Alistair McGuire. Economic Evaluation in Health Care. New York: Oxford University Press, 2001.
5. Frederick Hiller, Gerald Lieberman. Introduction to Operations Research (9th edition). McGraw-Hill Science/Engineering/Math; 2009

Grading: Late assignments will receive no credit.

- Attendance and class participation 10%
- Homework 20%
- Term project milestones 15%
- Term project paper 40%
- Term project presentation 15%

Course Schedule:

Class	Date	Topic	Due at the beginning of class:
1	1/9	Introduction	
<u>Overview of Model Frameworks</u>			
2	1/11	Decision Trees	
3	1/16	MLK day: No Class.	
<u>Cost-Effectiveness and Compartmental Models</u>			
4	1/18	Cost-effectiveness Analysis	Reading 1
5	1/23	Cost-effectiveness Analysis: QALYs and Costs	Project Milestone 1
6	1/25	Markov Processes and Compartmental Models	Reading 2
<u>Model Inputs</u>			
7	1/30	Acquiring model parameters	
<u>Compartmental Models Research Examples</u>			
8	2/1	Compartmental Models: Research Examples	HW 1
9	2/6	Compartmental Models of Infectious Disease	
<u>Microsimulation Models</u>			
10	2/8	Microsimulation and Agent Based Models	Reading 3
11	2/13	Microsimulation: Research Examples	
<u>Model Inputs II</u>			
12	2/15	Interpreting regressions for models	
13	2/20	President's day: No Class.	
<u>Calibration and Validation</u>			
14	2/22	Calibration and Validation I	Project Milestone 2
15	2/27	Calibration and Validation II	
16	3/1	Bayesian Methods in Modeling I	
17	3/6	Bayesian Methods in Modeling II	
18	3/8	Bayesian Methods in Modeling III	HW 2
19	3/13	Spring Break: No Class	
20	3/15	Spring Break: No Class	
<u>Optimization Models</u>			
21	3/20	Optimization for Healthcare Applications	
22	3/22	Optimization: Research Examples	Reading 4
<u>Sensitivity Analysis</u>			
23	3/27	Sensitivity Analysis	Project Milestone 3
24	3/29	Sensitivity Analysis: PSA	

<u>Capacity Planning, MDPs, and Queuing Models</u>			
25	4/3	Capacity Planning: Research Examples	HW 3
26	4/5	Markov Decision Processes in Healthcare	
27	4/10	Markov Decision Processes: Research Examples	Reading 5
28	4/12	Queuing	
29	4/17	Queuing: Research Examples	Reading 6
<u>Value of Information Analysis</u>			
30	4/19	Value of Information Analysis	
31	4/24	EVSI, EVPI	Reading 7
<u>Student Presentations and Paper</u>			
32	4/26	Student Presentations	
Final	TBA	Final Paper due	Final paper due

Readings:

- Reading 1: CEAs
Weinstein MC, O'Brien B, Hornberger J, Jackson J, Johannesson M, McCabe C, Luce BR. Principles of good practice for decision analytic modeling in health-care evaluation. *Value in Health* 2003;6:9-17.
- Reading 2: Compartmental Models
Hutton DW, Tan D, So SK, Brandeau, ML. Cost effectiveness of hepatitis B screening and vaccination among adult Asian and pacific islanders in the United States, *Annals of Internal Medicine*, 2007, Vol. 147, pp. 460-469.
- Reading 3: Simulation
Suen SC, Bendavid E, Goldhaber-Fiebert JD. Disease control implications of India's changing multi-drug resistant tuberculosis epidemic. *PLoS One*. 2014 Mar; 9(3):e89822.
- Reading 4: Optimization
Stefan Klöppel, et. Al. Automatic classification of MR scans in Alzheimer's disease, *Brain*, 2008, 131 (3): 681-689.
- Reading 5: MDP
Shechter SM, Bailey MD, Schaefer AJ, Roberts MS. The optimal time to initiate HIV therapy under ordered health states. *Operations Research* 2008; 56:20-33.
- Reading 6: Queuing
de Bruin AM, van Rossum AC, Visser MC, Koole GM, Modeling the emergency cardiac in-patient flow: an application of queuing theory, *Health Care Manag Sci*. 2007 Jun;10(2):125-37
- Reading 7: VOI
Ades, AE, Lu G, Claxton K. Expected value of sample information calculations in medical decision modeling. *Med Decis Making*; 24(2), 207-27.

Project Milestones and Final Paper:

Milestone 1: Identify your project team members (up to 3 students on a team), your research question, and motivate the research problem. Why is this an important topic? Will it help inform health policy decision makers?

Milestone 2: Describe the structure of your model. Why did you choose this model structure? What advantages and disadvantages are there? Identify data sources for parameterizing your model, and describe how you will build and calibrate the model. The level of detail should be similar to the Methods section of a research article. Responses should be between 2-3 pages double spaced.

Milestone 3: Describe your preliminary results. If these results are correct, what implications do they have for health policy? What additional analyses need to be completed? Describe how you will perform sensitivity analyses. Responses should be between 2-3 pages double spaced.

Final Paper: The final paper should have the following sections, and be limited to 10 pages double spaced, not including tables, figures, and references:

- Introduction/Motivation: What is your research question and why should we care?
- Methods: What did you do to answer the question and why is this reasonable?
- Results: What did you find? How sensitive are they to model assumptions?
- Discussion: What do your results mean? What limitations are there to this study?
- Future Work: If you had more time, what additional resources would you use and how would you use them?

University policies:

- *Statement for Students with Disabilities.* Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to your course instructor (or TA) as early in the semester as possible. DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Website and contact information for DSP:
http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740 – 0776n (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX), ability@usc.edu.
- *Statement on Academic Integrity.* USC seeks to maintain an optimal learning environment. General Principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work from misuse by others as well as to avoid using another's work as ones own. All students are expected to understand and abide by these principles. SCampus, The Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review should there be any suspicion of academic dishonesty. The Review process can be found at: <http://usc.edu/student-affaris/SJACS/>. Information on intellectual property at USC is available at: <http://usc.edu/academe/acsen/issues/ipr/index.html>.
- *Emergency Preparedness/Course Continuity in a Crisis.* In case of emergency, when travel to

campus is difficult, if not impossible, USC executive leadership will announce a digital way for instructors to teach students in their residence halls or homes using a combination of the Blackboard LMS (Learning Management System), teleconferencing, and other technologies. Instructors should be prepared to assign students a "Plan B" project that can be completed "at a distance". For additional information about maintaining your classes in an emergency, please access: <http://cst.usc.edu/services/emergencyprep.html>.