



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

HPM 772
Techniques for the Economic Evaluation of Health Care
(Credit Hours: 3)
Department of Health Policy and Management
Gillings School of Global Public Health

Fall 2018 Syllabus
Class Location (McGavran Greenberg 2308)
Meeting Times (T/R 2:00-3:15PM)

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Office Hours:	Tuesdays 12:30-2:00PM and by appointment in Rosenau 116	Thursdays 12:30-2:00PM and by appointment in MHRC 015
Course	Intro Statistics [eg, BIOS 600 or SPH Core or HPM 881 or HPM 470];	
Pre-requisites	AND Intro Epidemiology [eg, EPID 600 or SPH Core or EPID 710]; <i>or permission of instructor</i> Proficiency/expertise with Microsoft Excel® <u>required</u> . Strongly recommended: Operations Research/Spreadsheet Modeling [HPM 770]; US Healthcare Systems [HPM 754]	

Course Overview

Health care technology is defined broadly as: “programs, processes, procedures, drugs or other interventions aimed at improving health, preventing disease, alleviating symptoms or postponing death of human populations”. This course provides an introduction to the methods and application of economic evaluation to health care technologies. Policy makers should allocate resources to the most efficient competing technologies and ensure equity in access to cost-effective technologies; these decisions can be informed, but not dictated by, qualitative and quantitative analyses. Topics covered in the course include basic methods used to identify policy issues, structure an economic evaluation, measure and summarize health outcomes and estimate their value to patients or to the public, identify resources used and estimate their costs, and construct and test mathematical models to make population and/or temporal predictions of outcomes, costs, and cost-effectiveness from limited data.

Learning Objectives and HPM Competencies

This course has two broad learning objectives: to teach students techniques (1) to conduct economic evaluation of health care, and (2) to understand, report and interpret results of economic analyses.

I. Techniques for Economic Evaluation of Health Care—Students will construct models of relationships between outcomes and cost measures that incorporate quantitative and qualitative information on the level of the decision and issues of ethics and values, reflecting the perspective of the analysis. Students also will identify relevant data and adjust these as needed for analyses (Objectives 1-5).

II. Reporting Results—Students are expected to understand the requirements for reporting economic analyses and be able to critique in a clear and appropriate manner economic evaluations (Objective 6).

<i>Course Learning Objective</i>	<i>Competencies*†</i>
1. Identify the strengths and weaknesses of different cost-effectiveness/cost-utility/cost-benefit designs and select the appropriate design for a study	AT, ST, 2, 4, 6, 7, 9
2. Understand the basic process required to conduct a cost-effectiveness/utility analysis, and be able to develop a plan for conducting such an analysis	AT, ST, 2, 4, 6, 7, 9
3. Identify the types of input data that will be needed to conduct a cost-effectiveness/cost-utility/cost-benefit analysis and where one might obtain these data	AT, ST, IS, 2, 4, 6, 7, 9
4. Identify and use appropriate outcomes measures, including utilities, quality-adjusted life years (QALYs), and disability-adjusted life years (DALYs)	AT, ST, IS, 4, 6, 7, 9
5. Analyze cost-effectiveness/utility models (including adjusting for time preference and inflation), calculating and interpreting incremental cost-effectiveness ratios, conducting simple sensitivity analyses, and placing results into the context of existing standards or other comparable technologies	AT, ST, 2, 4, 6, 7, 9
6. Critique economic evaluation studies	AT, ST, CS, 10

*HPM Master’s Program Competencies: AT, Analytical Thinking; CS, Communication Skills; IS, Information Seeking; ST, Systems Thinking

†HPM PhD Core Competencies: 2. Develop expertise in a substantive area (a minor); 4. Identify and appropriately apply theoretical knowledge and conceptual models in support of health services/health policy research; 6. Select appropriate research designs and methodologies (quantitative and qualitative) for health services/health policy research; 7. Understand and appropriately apply analytical strategies used in health services/health policy research; 9. Interpret and explain the results of research; 10. Critically evaluate articles from scholarly journals and research presentations. Source:

http://www2.sph.unc.edu/images/stories/academic_programs/hpaa/documents/docguide_2013_2014.pdf (page 9).

Resources

Website:

HPM 772 has its own website using Sakai software (See <http://sakai.unc.edu>.) All registered students are automatically enrolled in the site. Auditors must be enrolled by the instructor. This website will be used extensively during the course, and students should check the site frequently for announcements, changes to the schedule, etc. Lecture slides and other materials will be posted on Sakai. All written assignments will be turned in and returned via the Sakai Assignment Tool. Students will be able to check grades on the website.

Textbooks:

Two books are required for all students in the course:

Muennig P and Mark Bounthavong. *Cost-Effectiveness Analysis in Health: A Practical Approach*. (3rd edition) San Francisco: Jossey-Bass, 2016. (Hereafter known as Muennig.)
<https://ebookcentral-proquest-com.libproxy.lib.unc.edu/lib/unc/reader.action?docID=4388576&query=>

Neumann, Peter J., Gillian D. Sanders, Louise B. Russell, Joanna E. Siegel, and Theodore G. Ganiats, eds. *Cost-Effectiveness in Health and Medicine*. Second edition. Oxford University Press, 2016. (Hereafter known as Neumann.)
<http://www.oxfordscholarship.com.libproxy.lib.unc.edu/view/10.1093/acprof:oso/9780190492939.001.0001/acprof-9780190492939>

Articles:

In addition, we have selected a limited number of articles to augment the textbook readings. These will be available on Sakai or through the Health Sciences Library.

Web Sources:

The course Sakai site lists a number of useful sources of information on economic analyses, the techniques used to conduct them and relevant data. These websites are listed in “External Links”. Students are encouraged to bring to the instructor’s attention other web resources, as well as to report broken or incorrect links.

Requirements and Expectations*Written In-Class Assignments (ICAs):*

Four, short, written assignments are required of *all* students. Each assignment is worth 18 points of the students’ final grade (out of 100 total points). These assignments will begin in class, to be completed outside of class. The purpose of these assignments is to help you relate materials from the readings, taught in lectures, and discussed as part of the See-One-Do-One (SODO) sessions to apply techniques required to conduct economic evaluation. You are encouraged to take these assignments seriously, and to turn in proofread and polished drafts. Although you may work in small groups of 2-3 students to brainstorm and discuss the solutions, each assignment must be individually completed (including the relevant Excel file) and submitted separately. Each ICA write-up will be approximately 3-5 pages (double-spaced, 11-point, not including references, tables, and/or figures). These assignments are due by 11:59PM on the dates noted in the schedule. Late assignments will be subject to a penalty. Detailed instructions and grading rubrics will be provided on the course Sakai site.

Final Exam:

Students have several options for their final exam (with varying points available for each option).

1. **Independent Modeling Project** — An *optional* independent modeling exercise (*required only* for HPM PhD Decision Sciences and Outcomes Research [DSOR] minors; optional for all others) is possible for those students interested in building a full economic evaluation model from scratch. These independent modeling projects will be presented by the *Modelers* as posters in a “research conference” to be held during the final scheduled class session on **Tuesday, December 4, 2018, at 2:00-3:30PM**. *Modelers* may receive a maximum of 28 points for successful completion of the independent modeling project. *All* students are expected to attend the research conference to be held during the final scheduled class session on **Tuesday, December 4, 2018, at 2:00-3:30PM**.
2. **Evaluation of Modeling Project** — *All* students are expected to attend the research conference to be held during the final scheduled class session on **Tuesday, December 4, 2018, at 2:00-3:30PM**. Students who elected not to pursue an independent modeling project (hereafter referred to as *Evaluators*) must critique one of the independent modeling projects and the accompanying poster presented by his/her peers. Critiques must be submitted by **11:59PM on Saturday, December 8, 2018**. *Evaluators* may receive a maximum of 18 points for successful completion of the critique.
3. **Online Exam** — *Evaluators only* have the additional option of taking an optional online final exam to further demonstrate their understanding of material covered throughout the semester. This exam will be accessible on Sakai **from Tuesday, December 4, 2018, at 2:00PM through Saturday, December 8, 2018, at 11:59PM**. Once accessing the exam, students will have a maximum of 3 hours to complete it (although we do not expect the exam to take this long to complete!) The optional online exam will be worth a maximum of 10 additional points for *Evaluators only*.

More detail on each of these final exam options is provided below

1. **Independent Modeling Project** — At the beginning of the semester, non-PhD DSOR students should decide whether they are interested in pursuing an independent modeling project. *HPM PhD DSOR students are required to complete this modeling exercise because it is a key competency in their training that will be tested during PhD qualifying/comprehensive exams for the DSOR minor.*

Every student planning to pursue an independent modeling project should meet with the Instructor(s) and/or TA within the first month of class to discuss their plans to determine feasibility. Feasibility of the independent modeling project, given the time constraints of the semester, must be carefully considered and demonstrated by the student. The topic of the modeling project may be an original idea or a replication of an existing published model. Model replications are an excellent way to practice modeling skills, if you don't know where to start with an original modeling idea but still want to pursue the modeling project. If an original idea, note that the instructors may be able to provide more specialized assistance/feedback on the following topics due to overlap with their own active research agendas: cancer; sexual/reproductive health;

obstetrics/gynecology; vaccination; care coordination; rural health; high ED/inpatient utilization; and insurance plan design.

Modelers will be expected to (1) develop the modeling research question (in consultation with the Instructor(s) and TA); (2) provide brief written updates about the modeling progress to the Instructor(s) and TA on the dates noted in the schedule; (3) program the model in Excel, including creating the structure, parameterizing the model, producing base-case solutions, as well as sensitivity analyses; and (4) develop and present a research poster summarizing the model at the aforementioned research conference to be held during the final scheduled class session on **Tuesday, December 4, 2018, at 2:00-3:30PM**. During this session, *Modelers* should focus on ensuring that the audience understands what has been done and why (a *Modeler* must be able to convey his/her work to many different audiences). Posters should contain the typical components included in an academic poster presentation (i.e., Research Question; Introduction/Rationale; Methods; Results; and Conclusion).

Required components of the independent modeling project:

- a. **Modeling Updates**—Two brief written updates will be required of *Modelers*. The purpose of these assignments is to help you relate materials taught in readings, lectures, SODOs, and ICAs to your modeling project and to provide an update to the Instructor(s)/TA so that they may assist you with the project. These assignments, when edited according to Instructor(s)/TA comments and feedback, should influence ongoing work on the modeling project and inform the development of the final research poster. Each update should be no more than 3 pages (double-spaced, 11-point, not including references, tables, and/or figures). These assignments are due by 11:59PM on the dates noted in the schedule. Detailed instructions will be provided on the course Sakai site.
- b. **Abstract and Research Poster**—*Modelers* will develop a research conference poster describing the model. The poster presentation should contain a concise description of the Research Question; Introduction/Rationale; Methods; Results; and Conclusion. *Modelers* should be prepared to give a 3-5 minute “elevator speech” summarizing their model and conclusions to audience members.

At the end of the semester, *Modelers* may wish to consider further developing/refining their model and writing it up for submission as an abstract for academic conference presentation or peer-reviewed publication. This is a very nice way to “extend” the work you’ve done in this course, and we are happy to help facilitate this effort outside of class as co-authors, if appropriate.

2. **Evaluation of Modeling Project**—*Evaluators* will be expected to (1) attend the entire research conference on **Tuesday, December 4, 2018, at 2:00-3:30PM**; (2) review, ask questions about, and analyze one independent modeling project presented by one of their *Modeler* peers; and (3) submit a structured review/critique of that modeling project and accompanying poster to be turned in no later than **11:59PM on Saturday, December 8 2018**. Structured rubrics for review/critique will be supplied in advance of the research conference. *Evaluators* are strongly encouraged to view multiple posters

presented by their peers during the research conference, but should spend more time with the *Modeler* whose project they are critiquing. *Evaluators* will be matched to specific projects in advance of the research conference; *evaluators* may request specific modeling projects to evaluate, based upon their interests.

3. **Online Exam** — *Evaluators* have the additional option of taking an online exam to further demonstrate their understanding of material covered throughout the semester. This exam will be accessible on Sakai **from Tuesday, December 4, 2018, at 2:00PM through Saturday, December 8, 2018, at 11:59PM**. Once accessing the exam, students will have a maximum of 3 hours to complete it. *Evaluators* are not required to complete the online exam, but doing so enables them to potentially earn an “H” in the course. The exam should not be discussed with anyone; doing so constitutes an honor code violation.

Expectations for Attendance and Participation:

In order to be successful learning experiences, your active participation is required in the lectures, SODO discussions and the in-class assignments. You will need to make certain that you have prepared thoroughly for the day’s activities, have all necessary materials, and come prepared with thoughtful questions. You are responsible for preparing all assigned readings in advance of the lecture period. Lecture slides will be available from the course website, but you are strongly encouraged to take your own detailed notes. You also are encouraged to bring to the attention of the instructor and course colleagues relevant items of interest. ICA interactions will occur in small working groups of 2-3 members (the membership of these groups is your choice, but may vary by activity if desired). Attendance during these sessions is required, so please make certain that you notify the instructor(s), TA, and relevant group members if you will miss one. Groups work best together if each member can be relied upon to be present, prepared and thoughtful every time. If you are absent, you have the potential to let your group down. Group members are likely to be accepting of an occasional absence if the absent member works hard and contributes regularly; they tend to be much less forgiving otherwise. Please make certain that your colleagues can count on you as much as you rely on them.

Guidelines for Use of Teaching Assistant (TA):

Generally, the TA should be your first stop for all clarifying questions related to course expectations, Excel troubleshooting, and understanding SODOs and ICAs. If an issue arises which the TA cannot resolve, then you should approach the Instructor. In general, when consulting with the TA via email, please be sure to “cc” the Instructor so that she understands what is happening (even if the TA is handling the issue). Email or office hour attendance are the best ways to communicate with the TA and Instructor. Based on students’ needs, the TA may offer recitation/review sessions at scheduled times to reinforce material. Students should ask the TA for such sessions if they feel multiple students are having the same issues.

Office Hours

As ICAs and projects tend to require individual, rather than group assistance, office hour sign-ups are provided for both TAs and for the instructor online. Students are able to sign up for 15-minute appointments in advance. This method guarantees students one-on-one time to get questions answers but does require students to make efficient use of this time- generally

arriving prepared with specific questions. Out of consideration to other students, we will be strict about starting and ending these appointments on time. No-shows are discouraged- if you sign up for a time and are unable to make it, please remove your name from the schedule to make room for other students. If you feel an issue will require longer than this time to address, you may make a separate appointment with the TA.

Late Assignment Policy:

All assignments are due as indicated in the syllabus. Late assignments are *strongly* discouraged and will result in a deduction of up to **25% of the total points available for the assignment** for each day that the assignment is late. Delays due to unforeseen and distressing events (serious illness, a death in the family) will be treated on a case-by-case basis; please notify the instructor(s) *immediately* should one of these events arise.

Cell Phones, Laptops, and Tablets:

Use of laptops in this class is appropriate for sessions using Excel software and for integrative activities. Please do not read/send e-mail or use the internet during class for anything aside from class purposes. Using the internet can be very distracting to your colleagues and the Instructor. Cell phones are to be used only in case of emergency and should be placed in “silent” (and not vibrating) mode. Your cooperation in this matter is truly appreciated.

Evaluation / Grading

A total of 100 points are possible in this course, as summarized below:

Component	Points
Required individual ICA write-ups (4 total, worth 18 points each)	72
Final exam options	
- Independent Modeling Project <i>For students conducting an independent modeling project (Modelers), this requires completing 2 modeling updates and the research conference poster presentation</i>	28
OR	OR
- Evaluation of Modeling Project <i>For students critiquing independent modeling projects (Evaluators), this requires attending the research conference poster presentations and submitting a structured, written critique of one modeling project/poster (assigned in advance)</i>	18
- Optional Online Exam <i>For students who elect to complete the optional online exam, this requires taking the exam via Sakai</i>	10
TOTAL	100

Grading Scale:

Your scores from each of the assignments will be combined to calculate your total score. Final grades will be assigned according to the following scheme:

93 and above	H
80 to 92	P
70 to 79	L
Below 70	F

Evaluation Criteria

Evaluation is specific to each assignment. Grading criteria (which will be made available on the course website in advance of each assignment) describe the required elements of each assignment and the weight placed on each of the elements. You are encouraged to print these criteria and use them as checklists to ensure that you have completed each element of the assignment. Among these criteria are:

- Clarity and thoughtfulness of written materials. Correct use of grammar and scientific terms is required.
- Effective, appropriate application of course materials and other resources in the written assignments.

Written communication is very important in our field. The following provides important information on writing cogent, professional scientific prose. You may find it helpful with this class as well as in writing your Masters paper, Doctoral dissertation, or any other professional communication.

Gopen G, Swan J. The Science of Scientific Writing. *American Scientist*. 1990 (Nov-Dec 1990), Volume 78, 550-558. <https://goo.gl/yZ4j>

Recognizing, Valuing, and Encouraging Diversity

The importance of diversity is recognized in the mission statement of HPM. In the classroom, diversity *strengthens* the products, *enriches* the learning, and *broadens* the perspectives of all in the class. Diversity requires an atmosphere of inclusion and tolerance, which oftentimes challenges our own closely-held ideas, as well as our personal comfort zones. The results, however, create a sense of community and promote excellence in the learning environment. This class will follow principles of inclusion, respect, tolerance, and acceptance that support the values of diversity.

Diversity includes consideration of: (1) life experiences, including type, variety, uniqueness, duration, personal values, political viewpoints, and intensity; and (2) factors related to “diversity of presence,” including, among others, age, economic circumstances, ethnic identification, family educational attainment, disability, gender, geographic origin, maturity, race, religion, sexual orientation, social position, and veteran status.

UNC Honor Code

The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work that students conduct at the University as they have during

the long life of this institution. Your acceptance of enrollment in the University presupposes a commitment to the principles embodied in the Code of Student Conduct and a respect for this most significant Carolina tradition. Your reward is in the practice of these principles.

Your participation in this course comes with the expectation that your work will be completed in full observance of the Honor Code. Academic dishonesty in any form is unacceptable, because any breach in academic integrity, however small, strikes destructively at the University's life and work.

If you have any questions about your responsibility or the responsibility of faculty members under the Honor Code, please consult with someone in either the Office of the Student Attorney General (966-4084) or the Office of the Dean of Students (966-4042). Read “The Instrument of Student Judicial Governance” (<http://instrument.unc.edu>).

Course Evaluation

HPM participates in the UNC-CH’s online course evaluation system, enabled at the end of the semester. Your responses will be anonymous, with feedback provided in the aggregate. Open-ended comments will be shared with instructors, but not identified with individual students. Your participation in course evaluation is an expectation, since providing constructive feedback is a professional obligation. Feedback is critical, moreover, to improving the quality of our courses, as well as for instructor assessment. In addition, at various points in the semester, the course instructor will solicit your feedback; your thoughtful and constructive participation is appreciated.

Disability Accommodation

UNC-CH supports all reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability, or a pregnancy complication resulting in difficulties with accessing learning opportunities. All accommodations are coordinated through the UNC Office of Accessibility Resources & Services (ARS), <http://accessibility.unc.edu>; phone 919-962-8300 or email accessibility@unc.edu. Students must document/register their need for accommodations with ARS before any accommodations can be implemented.

Counseling Services

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

Course Schedule

Dates	Topics
August 21	<p>Introduction and Course Overview This session provides an overview of course content and describes how the course is structured and operates.</p>
Readings & Assignments:	None
MODULE 1:	CONDUCTING ECONOMIC EVALUATION IN HEALTH CARE
August 23	<p>Introduction to Economic Analysis (Lecture) This course is based on the premise that we currently know how to treat or prevent more disease than we are willing to pay for. Thus, the allocation of resources to the most efficient competing technologies and equity in access to cost-effective technologies are essential health policy issues that should be informed, but not dictated by, qualitative and quantitative policy analyses.</p> <p>This session introduces economic analysis methods, including cost-effectiveness, cost-utility, and cost-benefit analysis. The purpose is to help you identify the strengths and weaknesses of different cost-effectiveness/cost-utility/cost-benefit designs and to select the appropriate design for a study.</p>
Readings & Assignments:	<p>Muennig Chapters 1 & 2</p> <p>Neumann Chapter 2 (sections 1-2.3), Chapter 5 (sections 1-6)</p> <p><i>“See One, Do One” (SODO)#1 - We will use this example throughout the semester to build an example model. Please bring the article with you to each class:</i></p> <p>Gold HT, Hall MJ, Blinder V, Schackman BR. Cost effectiveness of pharmacogenetic testing for UGT1A1 before irinotecan administration for metastatic colorectal cancer. <i>Cancer</i>. 2009;115(17):3858–67. doi:10.1002/cncr.24428. http://libproxy.lib.unc.edu/login?url=http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2853177/pdf/nihms149920.pdf</p>
August 28	<p>Planning an Economic Evaluation and Introduction to Needed Data (Lecture) To conduct an economic evaluation, we will need to bring together information and data from a wide variety of sources. This session provides a basic understanding of the process of conducting a cost-effectiveness/utility analysis (study planning), the types of data you will need, and where to find the data you need (information retrieval). As we</p>

	work through the modeling process and our projects during the semester, we will cover in greater detail specific data and how to use them.
Readings & Assignments:	<p><i>Study Planning:</i> Muennig, Chapter 3.</p> <p>Neumann Chapter 4</p> <p><i>Information Retrieval:</i> Muennig, Chapters 11 & 12.</p> <p>Please note that this session provides a <u>basic</u> framework for the data and information you will need; at the end of this session you will not have comprehensive knowledge or expertise. Multiple, subsequent sessions will cover this information in more detail.</p>
MODULE 2A:	<p>DECISION MODELING TECHNIQUES: DECISION TREES</p> <p>Decision analysis is a systematic, quantitative approach for assessing the relative value of one or more different decision options. It is a useful tool when the clinical or policy decision is complex and information is uncertain. We will first discuss decision modeling, generally, and then decision trees specifically—with the sessions structured to include lectures, class discussion of the SODO#1 (Gold et al., 2009), and an in-class assignment related to decision trees. Attention will be paid to the types of data needed to design and populate these types of models.</p>
August 30	Introduction to Decision Models 1 (Lecture)
Readings & Assignments:	<p>Muennig, Chapter 5.</p> <p>Re-read and bring to class Gold et al. (2009).</p>
September 4	Introduction to Decision Trees 2 (Lecture)
September 6	Guest Lecture on How to Dig into a Modeling Project—Joehl Nguyen (Department of Pharmaceutical Outcomes and Policy)
September 11	SODO#1—Gold et al. (2009)—Modeling with Decision Trees
September 13	Begin ICA#1 [Decision Tree] to reinforce material (Bring pencil/pen, paper, and laptop to class)
MODULE 2B:	<p>DECISION MODELING TECHNIQUES: MARKOV MODELS</p> <p>Markov models are used to represent repetitive (recursive) events/random processes over time, and thus are commonly used when events reoccur or risk extends over long periods of time (e.g., with chronic diseases). When incorporated within a decision analytic model, they can be used to estimate the lifetime costs and life expectancy for different treatment options. In</p>

	<p>these sessions, we will learn the techniques of Markov modeling and explore the types of data we will need to design and populate these models. The first 2 sessions will consist of lecture, with the subsequent sessions structured as in-class discussion of SODO#2 and ICA#2 to reinforce the material.</p>
September 18	Introduction to Markov Models 1 (Lecture)
Readings & Assignments:	<p>Muennig, pp. 147-150. (Simple summary of Sonnenberg and Beck)</p> <p><i>See One, Do One” (SODO)#2 (hereafter known as Chancellor et al., [1997]):</i> Chancellor JV, Hill AM, Sabin CA, Simpson KN, Youle M. Modeling the Cost Effectiveness of Lamivudine/Zidovudine Combination Therapy in HIV Infection. <i>PharmacoEconomics</i>. 1997; 12(1): 54-66.</p>
September 20	More on Markov Models 2 (Lecture) (SPENCER)
Readings & Assignments:	<p>Sonnenberg FA, Beck JR. Markov Models in Medical Decision Making: A Practical Guide. <i>Med DecisionMaking</i>. 1993; 13: 322-338.</p> <p>Briggs A, Sculpher M. An Introduction to Markov Modeling for Economic Evaluation. <i>PharmacoEconomics</i>. 1998; 13(4): 397-409.</p>
	By Sept. 20: ICA#1 Written Response Due
September 25	SODO#2—Chancellor et al. (1997)—Modeling with Markov Structures
September 27	Begin ICA#2 (Markov Models) to reinforce material (Bring pencil/pen, paper, and laptop to class)
MODULE 3:	<p>HOW TO WRITE AND CRITIQUE AN ECONOMIC EVALUATION The purpose of this period is to reflect on the different pieces we have just learned and bring them together in a coherent fashion. We will talk extensively about writing up and critiquing economic evaluations. We also will finalize modeling project topics.</p>
October 2	How to Write and Critique an Economic Evaluation (Lectures)
Readings & Assignment:	<p>Neumann Chapter 13</p> <p>Muennig, Chapter 10</p> <p>Review the following documents, as they provide standards for what is good practice in the conduct and description of economic evaluations. Evaluators will need this information to critique modeling projects. Modelers will need these documents so that they properly conduct and describe their analysis.</p>

	<p>Husereau D, Drummond M, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. <i>Value Health</i> 2013;16:231-50.</p> <p>Caro JJ, Briggs AH, Siebert U, Kuntz KM. Modeling Good Research Practices—Overview: A Report of the ISPOR-SMDM Modeling Good Research Practices Task Force—1. <i>Med Decis Mak.</i> 2012;32(5):667-677. doi:10.1177/0272989X12454577.</p> <p>Consensus Conference on Guidelines on Economic Modelling in Health Technology Assessment. Decision Analytic Modelling in the Evaluation of Health Technologies. <i>Pharmacoeconomics.</i> 2000; 17(5): 443-444.</p> <p>Sculpher M, Fenwick, E, and Claxton K. Assessing the Quality in Decision Analytic Cost-Effectiveness Models. A Suggested Framework and an Example of Application. <i>Pharmacoeconomics.</i> 2000; 17(5): 461-477. (Read Tables I and II in depth as a reference)</p>
MODULE 4:	MODEL INPUTS: COSTS AND OUTCOMES This module covers economic and epidemiologic inputs to decision models
October 4	Costs, Costing and Discounting (Lecture)
Readings & Assignments:	Neumann Chapters 3, 8, and 10
	By Oct. 4: ICA#2 Written Response Due
October 9	Guest Lecture on Costing—Justin Trogon (Department of Health Policy and Management)
October 11	Adding Costs to our SODO Model (Chancellor et al., 1997)
	By Oct. 11 Modelers Must Turn in Modeling Update #1 (Independent Modeling Project Topics must be finalized, after meeting with Instructor(s)/TA. Modelers must submit Brief Description of Research Question/Objective, Rationale, and Basic Modeling Approach)
October 16	Adding Costs to our SODO Model (Gold et al., 2009) (GOGATE)
October 18	FALL BREAK- NO CLASS
October 23	ICA#3- Part A (Costing) to reinforce material (Bring pencil/pen, paper, and laptop to class)

<p>October 25</p>	<p>Health-Related Quality of Life, Utilities, and QALYs 1 (Lecture) In economic analyses, a number of different health outcomes employed to measure the effect of the technology; these outcomes range from the reduction of mortality and/or morbidity to improvements in health-related quality of life (HRQoL). In these three sessions, we will examine the theoretical basis of HRQoL and how it is commonly measured and how these measures are used in economic analysis in the high-source countries and low- to middle-resource countries. Learning objectives for the cost portion of this module are:</p> <ul style="list-style-type: none"> • Identify and use appropriate outcome measures, including utilities, quality-adjusted life years (QALYs), and disability-adjusted life-years (DALYs) • Understand the importance of analytical perspective in the identification and selection of outcomes and outcome measures. • To adjust for time preference, appropriately use discounting to adjust outcomes
<p>Readings & Assignments:</p>	<p>Meunnig, Chapters 6-8 Neumann Chapter 7</p>
<p>October 30</p>	<p>Adding Outcomes to our SODO Model(s)</p>
<p>November 1</p>	<p>ICA#3- Part B (Outcomes) to reinforce material (Bring pencil/pen, paper, and laptop to class)</p>
<p>Readings & Assignments:</p>	<p><i>The following data sources may be useful for the ICA:</i></p> <p>Sullivan PW, Ghushchyan V. Mapping the EQ-5D Index from the SF-12: US General Population Preferences in a Nationally Representative Sample. <i>Med Decis Making</i>. 2007;26:401-409. Additionally, see Excel EQ-5D catalogue at www.ohsu.edu/epc/mdm.</p> <p>Sullivan PW, Ghushchyan V. Preference-Based EQ-5D Index Scores for Chronic Conditions in the United States. <i>Med Decis Making</i>. 2007;26:410-420. See additional technical appendix.</p> <p>Tufts University Medical Center. Cost-Effectiveness Analysis Registry. https://research.tufts-nemc.org/cear4/</p>
<p>MODULE 5:</p>	<p>BASE-CASE ANALYSIS: INTERPRETING COST-EFFECTIVENESS RATIOS We have now learned to develop decision models (e.g., decision trees, Markov models, or hybrids) and collected cost and outcome data. Is our new technology cost-effective compared to current practice? In the first three sessions, we learn how to calculate the total costs and outcomes of</p>

	<p>each technology and to compare them across technologies to determine the incremental costs and effectiveness of implementing the new technology. In doing so, we learn how to calculate and interpret the incremental cost-effectiveness ratio in the context of existing standards and other technologies. In the fourth session we will begin to learn how to use Crystal Ball® software, which we will use to analyze the uncertainty in our models. The learning objectives for this module is to analyze cost-effectiveness/utility models, calculating and interpreting incremental cost-effectiveness ratios, and placing results into the context of existing standards or other comparable technologies.</p> <p>The first session is a lecture, with the subsequent sessions structured as in-class discussions of SODOs #1 and #2, and in-class activity/exercise to reinforce the material.</p>
<p>November 6</p>	<p>Calculating, Displaying and Interpreting Cost-Effectiveness Ratios (Lecture)</p>
<p>Readings & Assignments:</p>	<p>Neumann Chapter 2 (sections 2-4)</p> <p>Husereau D, Drummond M, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. <i>Value Health</i> 2013;16:231-50.</p> <p>Revised CHEERS-Checklist Oct13.pdf (See Sakai under “How to Write and Critique an Economic Evaluation”)</p> <p>Drummond M, Torrance G, and Mason J. Cost-effectiveness League Tables: More Harm than Good? <i>Social Science and Medicine</i>. 1993; 37(1): 33-40.</p> <p>Chapman, RH, Stone PW, Sandberg EA, Bell C., and Neumann PJ. A Comprehensive League Table of Cost-Utility Ratios and a Subtable of "Panel-Worthy" Studies. <i>Medical Decision Making</i>. 2000; 20: 451-467.</p>
<p>November 8</p>	<p>Analysis and Interpretation of SODO Model(s)</p>
<p>Readings & Assignments</p>	<p>By Nov. 8: ICA#3 Written Response Due</p>
<p>November 13</p>	<p>Sensitivity Analysis (Lecture)</p> <p>Uncertainty arises in the process of model building and in the data we used to estimate decision tree probabilities, costs, and outcomes; we also made a number of assumptions to simplify our models. What effect does this uncertainty have on whether our new technology continues to cost-effective? How much do our cost estimates have to change before we</p>

	would not adopt the new technology? Deterministic sensitivity analyses are used to evaluate the effects of uncertainty. The session learning objective is to conduct deterministic sensitivity analysis, including selection of variables and one- and two-way analysis techniques, and appropriately interpret results.
Readings & Assignments:	Neumann Chapter 11 (sections 1-6) Meunnig, Chapter 9
November 15	Adding Sensitivity Analysis to our SODO Model(s)
Readings & Assignments:	Petitti DB. Meta-Analysis, Decision Analysis, and Cost-Effectiveness Analysis: Methods for Quantitative Synthesis in Medicine. New York: Oxford: Oxford University Press, 1999, Chapter 15. Schackman BR, Taffet Gold H, Stone PW, Neumann PJ. How often do Sensitivity Analyses for Economic Parameters Change Cost-utility Analysis Conclusions? <i>Pharmacoeconomics</i> . 2005;22(5): 293-300. (Interesting, but skim only)
	By Nov. 15, Modelers Must Turn in Modeling Update #2 (Brief Description of Input Data and Outcomes)
November 20	ICA#4 (Interpretation & Sensitivity Analysis) to reinforce material (Bring pencil/pen, paper, and laptop to class)
November 22	THANKSGIVING HOLIDAY—NO CLASS
November 27	Advanced Sensitivity Analysis Briggs AH. Handling Uncertainty in Cost-Effectiveness Models. <i>Pharmacoeconomics</i> . 2000; 17(5): 479-500. Briggs AH, O'Brien BJ, Blackhouse G. Thinking Outside the Box: Recent Advances in the Analysis and Presentation of Uncertainty in Cost-Effectiveness Studies. <i>Handling Uncertainty in Cost-Effectiveness Models. Annual Review of Public Health</i> . 2002; 23: 377-401. (This article introduces the net-benefit approach, which has become very popular during the previous five years.)
November 29	Guest Lecture on Advanced Modeling Techniques—Leah Frerichs (Department of Health Policy & Management) By November 29: ICA#4 Written Response Due
December 4	Last Day of Class and Modeler Project Poster Session

Readings & Assignments:	On Dec. 4: Modelers Must Present Modeling Project
December 8	By Dec. 8: Evaluators Must Submit Critique of Modeling Project By Dec. 8: Optional Online Exam Must Be Completed by Evaluators

Schedule of Deliverables

Dates	Topics
Sept. 20	ICA#1 Written Response Due
Oct. 4	ICA#2 Written Response Due
Oct. 11	Modelers Must Turn in Modeling Update #1 (Independent Modeling Project Topics must be finalized, after meeting with Instructor(s)/TA. Modelers must submit Brief Description of Research Question/Objective, Rationale, and Basic Modeling Approach)
Nov. 8	ICA#3 Written Response Due
Nov. 15	Modelers Must Turn in Modeling Update #2 (Brief Description of Input Data and Outcomes)
Nov. 29	ICA#4 Written Response Due
Dec. 4	Modelers Must Present Modeling Project at Research Conference
Dec. 8	Evaluators Must Submit Critique of Modeling Project and Optional Online Exam Must Be Completed by Evaluators