CLRES 2121 / HPM 2217	Course Instructors: Mark Roberts, MD, MPP
Clinical Decision Analysis	Cindy Bryce, PhD
10/05 – 11/02 (M, Th 3:00 – 5:00)	Kenneth Smith, MD, MS
305A Parkvale Bldg	Phone contact: (412) 692-4826

This course provides an introduction to the use of decision sciences in health care. In addition to developing a conceptual understanding of medical decision making, the course will develop technical skills in decision analysis including the creation and evaluation of decision trees, the use of sensitivity analysis, and the incorporation of specific patient preferences through the use of utility analysis. The advantages and disadvantages of formal mathematical models for the analysis of clinical conditions will be presented, and examples from the current medical literature will be discussed.

Teaching Assistant – Sakine Batun (sab79@pitt.edu).

Course Requirements

Problem sets (2)	40%
Class participation	15%
Final project	45%

Students are expected to show their work (e.g., formulas, calculations) on all problem sets and on the final examination. When details of a solution are not provided, the point valuation of the student's answer is left to the discretion of the instructors.

Course Mechanics

1.0-credit course ; 2 hours/session, 2 sessions/week (total: 8 sessions)

There is no required textbook for this class. A selection of articles will be provided online.

Optional textbooks

Sox HC, Blatt MA, Higgins MC, Marton KI. *Medical Decision Making.* American College of Physicians, United States, 2007.

Petitti DB. *Meta-Analysis, Decision Analysis, and Cost-Effectiveness Analysis.* Oxford University Press, New York, 2000.

Final Project

For the final class project, prepare a brief (3–5 pages) proposal for a decision-analytic project that you would like to develop. The proposal should include the following:

- Specific Aims
- Background. You do not need to complete an exhaustive literature review, but you do need to motivate your project and place it in context with prior research.
- Research Methods. Describe your research project, including a description of the data sources, the type of data you will collect, your inclusion/exclusion criteria, your analysis plan, and limitations/contributions of the project.

Proposals are due no later than 3:00 on Monday, November 9 and should follow these formatting guidelines:

1. Maximum page length: 5 pages
2. Use Arial 11 point font.
3. Use 1-inch margins on all sides.

NOTE: There will be NO CLASS on Monday, October 19.

Session 1	10/05	Introduction and foundation of medical decision making	Roberts

Concepts and Topics

1. Introduction to the need for decision analysis and conditions required for a problem to be appropriately addressed by a formal decision analysis
2. Prescriptive versus descriptive analysis of problems
3. Examples of clinical/social problems addressed by decision analysis
4. Basic elements of decision analysis (nodes, branches, probabilities, outcomes)

Required Reading (prior to session)

1. Detsky AS, Naglie G, Krahn MD, Naimark D, Redelmeier DA. Primer on medical decision analysis: Part 1--Getting started. *Medical Decision Making*. 1997; 17(2): 123-5.
2. Albert DA. Decision theory in medicine: a review and critique. *Milbank Memorial Fund Quarterly/Health and Society*. 1978; 56(3): 362-401 ***(especially pages 362-379)***.
3. McCarthy BD, Wong JB, Muñoz A, Sonnenberg FA. Who should be screened for HIV infection? A cost-effectiveness analysis. *Arch Intern Med*. 1993; 153: 1107-1116.

Optional Reading

1. Sox, chapters 1-3

Session 2	10/08	Mechanics of decision analysis, probability review	Bryce

Concepts and Topics

1. Review of decision analysis elements (nodes, branches, probabilities, outcomes)
2. Constructing models: equivalence of conceptual model with mathematical construct
3. Common structural error and pitfalls
4. Details of evaluation (averaging out/folding back)
5. Review of probability rules

Required Reading (prior to session)

1. Detsky AS, Naglie G, Krahn MD, Redelmeier DA, Naimark D. Primer on medical decision analysis: Part 2--Building a tree. *Medical Decision Making*. 1997; 17(2): 126-35.
2. Sonnenberg FA, Roberts MS, Tsevat J, Barry M, Kent DL. Toward a peer review process for medical decision analysis models. *Medical Care* 1994; 32(7): JS52-64.

Optional Reading

1. Sox, chapter 3, 6

Session 3	10/12	Bayes' Theorem, diagnostic testing	Bryce

Concepts and Topics

1. Review of probability rules and Bayes' Theorem
2. 2x2 contingency tables
3. Diagnostic testing
4. Likelihood ratios

Required Reading (prior to session)

1. Naglie G, Krahn MD, Naimark D, Redelmeier DA, Detsky AS. Primer on medical decision analysis: Part 3--Estimating probabilities and utilities. *Medical Decision Making*. 1997; 17(2):136-41.

Optional Reading

1. Sox, chapters 3-5

Session 4	10/15	Value of information and sensitivity analysis	Roberts

Concepts and Topics

1. Receiver Operating Characteristic (ROC) curves
2. Uses of sensitivity analysis
   - Patient subgroups, examining outcomes in different risk sets
   - Testing the model's robustness to errors in assumptions
   - Providing information on critical values and areas for further research
3. One-way sensitivity analysis, thresholds
4. Two- and three-way sensitivity analyses

Required Reading (prior to session)

1. Krahn MD, Naglie G, Naimark D, Redelmeier DA, Detsky AS. Primer on medical decision analysis: Part 4—Analyzing the model and interpreting the results. *Medical Decision Making*. 1997; 17(2): 142-51.

Problem Set #1 due

REMINDER – No class on Monday, 10/19

Session 5	10/22	Markov processes	Smith

Concepts and Topics

1. Limitations of static trees/nodes for modeling events that occur over time or repetitively
2. Life expectancy models and survival analysis

Required Reading (prior to session)

1. Sonnenberg FA. Beck JR. Markov models in medical decision making: a practical guide. *Medical Decision Making*. 1993; 13(4): 322-38.

Optional Reading

1. Naimark D, Krahn MD, Naglie G, Redelmeier DA. Detsky AS. Primer on medical decision analysis: Part 5--Working with Markov processes. *Medical Decision Making*. 1997; 17(2): 152-9.
2. Friedman LS, Roberts MS, Brett AS, Marton KI. Management of asymptomatic gallstones in the diabetic patient - a decision analysis. *Annals of Internal Medicine*. 1988; 109: 913-19.

Session 6	10/26	Infectious disease modeling	Smith

Concepts and Topics

In many infectious diseases, incidence of disease in susceptible persons varies dynamically based on the number of persons already infected. As a result, these diseases are not well represented by conventional decision models, where disease likelihood is typically independent of the number affected and modeled statically. Simple infectious disease compartment models will be introduced, and insights that might be gained from them will be explored.

Required Reading (prior to session)

Anderson RM, May RM. 1982. Directly transmitted infectious diseases: control by vaccination. Science, 215: 1053-60.

Session 7	10/29	Utility assessment and the value of outcomes	Bryce

Concepts and Topics

1. Utility theory, preferences, and the value of intermediate states
2. Understanding the perspective of the analysis
3. Methods of assessment (relative value scale, time trade-off, standard gamble)
4. Comparison of utility based vs. functional and survey-based quality of life measurements
5. Multi-attribute utility theory

Required Reading (prior to session)

1. Feeny DH. Torrance GW. Incorporating utility-based quality-of-life assessment measures in clinical trials. Two examples. *Medical Care*. 1989; 27(3 Suppl): S190-204.
2. Torrance GW. Utility approach to measuring health-related quality of life. *Journal of Chronic Diseases*. 1987; 40(6): 593-603.

Optional Reading

1. Sox, chapters 7-8

Session 8	11/02	Monte Carlo simulation and discrete event simulation	Roberts

Concepts and Topics

The purpose of this session is to introduce methods that can be used to create more complex models that represent the level of detail that is required for clinical acceptance and credence. Monte Carlo simulation (or individual microsimulation) can be used to develop models where the actual characteristics of individual patients can be tracked through time, releasing the restrictive "lack of memory assumption" that plagues Markov Models. Several examples will be presented and discussed.

Required Reading (prior to session)

Shecter SM, Bryce CL, Alagoz O, Kreke JE, Stahl JE, Schaefer AJ, Angus DC, Roberts MS. 2005. A clinically based discrete event simulation of end-stage liver disease and the organ allocation process. *Medical Decision Making*, 25: 199-209.

Problem Set #2 due

FINAL PROJECT DUE: 11/09 at 3:00