Medical Decision Making
Spring 1997
Tuesdays, 4-6 pm, CME 990

Instructor

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Format

This is a course on the psychology of decision making as applied to health care. My background is in judgment and decision making; most of you have a background and clinical experience in health care. Accordingly, this class is a collaborative effort. I will introduce you to decision making concepts, you will offer clinical applications, and together we will discover how useful the concepts are for medicine. The class will consist of a mixture of:

- Lecture and discussion of key concepts
- Presentation and discussion of readings and clinical applications
- Discussion of computer exercises

Assignments

Assignments for each week are listed with each class topic in the syllabus. There are two basic types of assignments:

- Written assignments ask questions that you should be prepared to discuss in class. To facilitate the discussion, please prepare a written answer of 1-2 pages.
- Computer exercises provide an opportunity for hands-on experience with decision analysis software tools. Each exercise will be discussed in class. You should print out spreadsheets or other computer exercises and bring them to class.

In addition, each of you will be asked to facilitate the discussion of one or two of the assigned readings during the course (readings marked with * will have student presenters). In most cases, everyone will have read each reading, so facilitators should present only a very brief summary of the reading, and should focus on asking critical questions about the reading.

There is a newsgroup for this course, called uic.class.mhpe494.mdm. I read it daily, and you should feel
Week 1 - January 13 - Introduction and example decisions

Lecture notes

To discuss:
- What is a decision? What is a judgment?
- Types of decisions: certainty, risk, uncertainty, and conflict
- Models of decision making: normative, descriptive, and prescriptive
- What is a good decision?

Week 2 - January 20 - Uncertainty

Lecture notes

Assignments due:
1. Complete the decision making questionnaire
2. Find two sources of numerical probabilities for a disease, outcome, complication, etc.

Reading:

To discuss:
- What are the pros and cons of quantifying uncertainty as probability?
- How can we assess the accuracy of probability judgments?
- Biases in probability judgment: conjunction fallacy, availability heuristic, hindsight bias
- How can we improve these judgments?

Week 3 - January 27 - Diagnostic Tests, part 1: Signal Detection

Lecture notes
Assignments due:  Computer exercise: sensitivity and specificity

- List the sensitivity and specificity of two laboratory tests or other sources of diagnostic information that you use. Where did you find this information?
- Using the spreadsheet, determine how many false positives and false negatives ("misses") you'd expect if you gave the test to a group of 150 sick patients and 150 well patients. What is the percent of correct classifications?
- If you could make a test more sensitive at the cost of specificity, or vice versa, which would you do? Why?

Here is a Quattro Pro version of the spreadsheet.

Reading:


To discuss:

- Signal detection: hits, misses, false positives, correct rejections, thresholds, ROC curves
- Sensitivity and specificity
- Prior and posterior probabilities: Bayes' theorem
- SPIN and SNOUT

Week 4 - February 3 - Diagnostic Tests, part 2: Bayesian Reasoning

Lecture notes
| Assignments due: | 1. Computer exercise: Bayesian reasoning  
|---|---|
| | a. For two laboratory tests, enter the name of the test and disease into the "Bayesian Reasoning" spreadsheet, along with the test sensitivity and specificity.  
| | b. From the graph, determine what the post-test probability is if the pre-test probability was 0.1 and the test was positive.  
| | c. From the graph, determine what the post-test probability is if the pre-test probability was 0.9 and the test was negative.  
| | d. Using the "With Thresholds" spreadsheet, enter the same information, as well as the threshold probability of disease above which you'd want to treat the patient (pick any number that seems reasonable to you).  
| | e. Below what pre-test probability should we not treat or test the patient? Above what pre-test probability should we treat the patient without testing? What should we do if the pre-test probability is between these numbers?  
| | 2. Feedback: Fill out this on-line feedback form to give Alan feedback on the course so far.  

Here are Quattro Pro versions of the Bayesian Reasoning and With Thresholds spreadsheets. Here's an Excel 4 workbook version.

| Class activity: | Demonstration of ILIAD, a Bayesian decision support system  

| Reading: |  
|---|---|

| To discuss: |  
|---|---|
| | a. How ILIAD works  
| | b. How to use likelihood ratios and combine them for multiple tests  
| | c. Why LR+ and LR- differ: the value of information  

**Week 5 - February 10 - Psychology of Diagnostic Reasoning**
Week 6 - February 17 - Preferences, Utilities, and Feelings

Lecture notes

Assignments due:

1. Describe a situation you've participated in where it was crucial to measure a patient's preferences. What outcomes did the patient need to evaluate and how was that done?

Class activity: Shared Decision Program video

Reading:


To discuss:

- What are utilities? Why and when is utility measurement important?
- Techniques of measurement: ratings, standard gambles, time trade-off; others
- Biases in utility measurement: framing, sunk costs, decision weights
weights

- Implications for patient empowerment and quality of life

Optional reading:


**Week 7 - February 24 - Multiattribute Outcomes and Time**

Lecture notes

| Assignments due: | 1. Describe a decision you have made that involved tradeoffs between different attributes of options. How did you take these attributes into account?  
2. Computer exercise: Multi-attribute utility |
|------------------|------------------------------------------------------------------------------------------------|

To discuss:  

- MAUT: importance weights, combining attributes, dominance, sensitivity analysis  
- Temporal discounting and biases in intertemporal choice: magnitude and sign effects, sequence effects

Optional reading:


**Week 8 - March 3 - Decision trees**
Assignments due: "How to read a decision tree" problem set

Reading:

To discuss:
- Elements of a tree: chance nodes, probabilities, outcomes, values
- Folding back a tree
- Sources of information
- Sensitivity analysis
- How often are decisions made like this? How often should they be?

Optional reading:

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**Week 9 - March 10 - Markov Models and Influence Diagrams**

Lecture notes

Assignments due: "How to read an influence diagram" problem set

Reading:

To discuss:
- Markov models: What and why?
- Elements of an influence diagram: value node, chance nodes, decision nodes, determinstic nodes, arcs
- Making decisions with a diagram: arc reversal and tree conversion
- What advantages do influence diagrams have over decision trees? What disadvantages?

Optional reading:

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**Week 10 - March 24 - Cost-Effectiveness Analysis**

Lecture notes
Assignments due:
1. Computer exercise: cost-effectiveness analysis. Here are the instructions and the spreadsheet (Excel 4 format)
2. Find an example of cost-effectiveness analysis from your field. Briefly summarize the decision, the costs and benefits, and the recommendation. Do you agree with the recommendation?

Reading:

To discuss:
- The crucial tension: social successes with individual failures
- Measuring cost and effectiveness
- Cost-effectiveness as a means of rationing
- Acceptability of health care rationing

**Week 11 - March 31 - Quantitative Judgment and Mathematical Models**

Lecture notes

Assignments due:
Find an example of a continuous quantitative judgment in your field (e.g. overall rating of medical school applications, predicting years of survival). What cues or pieces of information go into this judgment? List them, and for each one, give an informal rating of the strength and direction of the relationship between the cue and the judgment. For example, I might say that MCAT scores have a positive relation to the overall rating of medical school applicants, and that this relation is very strong relative to other cues.

Reading:

To discuss:
- Brunswik lens model
- When do linear models outperform human judges?
- Bootstrapping (when there is no measure of the criterion)
- Policy capturing
- Insight: do judges know what cues they’re using?
- Other models: Artificial neural networks, heuristics

Optional Reading:

**Week 12 - April 7 - Clinical Practice Guidelines and Prediction Rules**

Lecture notes
## Assignments due:
Find an example of a practice guideline or prediction rule from your field from a literature search or other source. Briefly describe the guideline, whether you agree with it, and what you know about how well it is followed.

## Reading:

## To discuss:
- How to construct practice rules and guidelines
- Do guidelines improve decision quality?
- Why don't clinicians follow practice guidelines?
- How to measure the accuracy of prediction rules
- Are rules more accurate than human judges? Why?

### Week 13 - April 14 - Group Decision Making

### Lecture notes

## Assignments due:
Describe the last group decision you were involved in. What was your role in the group? How did the group reach its decision? Was there a decision rule involved (majority, consensus, leader decides)?

## Class activity:
Group decision case: The Hospital Committee

## Reading:

## To discuss:
- When do groups perform better than individuals? When do they perform worse?
- Group roles: brainstorming, advising, problem-solving, decision making
- Group decision rules
- Group biases: groupthink, escalation of commitment, focus on shared information
- How can group decision making be improved?

### Week 14 - April 21 - Ethical Decisions and Decision Making Ethics
Assignments due: With your teammates, prepare arguments about whether decision analysis is the normative approach to ethical problems. Details to follow.

Class activity: Debate: Can decision analysis resolve ethical dilemmas?

Reading:

To discuss:
- How do ethical dilemmas differ from other decisions?
- Do the same methods apply to ethical and personal decisions?
- Utilitarianism as a moral theory of decision making
- Actions, outcomes, and omission bias
- Social dilemmas

Week 15 - April 28 - Improving Health Care Decisions

Assignments due: Describe three ways of improving health care decisions. Be as specific as possible. For example, if you advocate teaching decision making to medical students, what would you teach, and why?

Reading:

To discuss:
- Errors (strategic and psychophysical) and how to correct them
- Clinical prediction rules and practice guidelines
- Decision analysis and cost-effectiveness analysis
- Education
- Decision aids and support systems

Resources

Here are additional books and web pages that may be of interest to you.

Medicine

The Society for Medical Decision Making is a society of clinicians, decision analysts, and decision scientists interested in improving decisions about medical care. It hosts an annual meeting and publish the journal Medical Decision Making.
John Clarke's Workshop on Surgical Decision Making is an excellent interactive tutorial on the web at http://www.auhs.edu/cgi-bin/tutorial/tutorial.cgi.

The Evidence-Based Medicine Toolbox at the Center for Evidence-Based Medicine at Oxford has a bunch of web-based explanations of diagnostic testing concepts, along with examples from the literature at http://cebm.jr2.ox.ac.uk/docs/toolbox.html.


Psychology

The Society for Judgment and Decision Making is an academic society, composed mostly of psychologists, that hosts an annual meeting devoted to presentations of research on judgment and decision making.


Business and Public Policy

The Decision Analysis Society of INFORMS maintains an excellent web site devoted to decision analysis.