



NORTHWESTERN  
UNIVERSITY

SCHOOL OF  
CONTINUING  
STUDIES

MED\_INF 406: Decision Support Systems and Health Care

Fall 2012

## Instructor and Teaching Assistant

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Preferred means of contact is email. If the matter is extremely time-sensitive, students should call our cell phones. We intend to have a close interaction with students and any opportunity to speak is given the highest level of importance and priority. Please note that all appointment times, sync sessions and scheduled calls will be in the Central Time Zone. There will be 2 sync sessions to take place during Sessions 4 & 6, subject to change with at least a 1-week advanced notice through an email sent by the Announcement function in Blackboard.

## Course Description

This course provides an introduction to clinical decision support systems in health information technology. Instruction is given in formal decision analysis techniques as they apply to decisions in the medical domain. Clinical decision support systems are introduced and issues relating to their design and implementation discussed. The mathematical foundations upon which they are based will be examined. Evidence-based guidelines and performance measurement techniques will be presented. A framework for designing and implementing clinical decision support systems will be introduced. Principles learned from this framework will be applied in writing a final paper that describes a prototype decision support system, including justification for its use and a description of steps followed in its design, implementation and performance measurement.

## Text

Hunink, H. & Glasziou, P. (2009). *Decision making in health and medicine: Integrating evidence and values (7th printing or later)*. Cambridge, England: Cambridge University Press.

Berner, E. S. (ed.). (2007). *Clinical decision support systems: Theory and practice (2nd ed. or later)*. New York, New York: Springer, Health Informatics Series.

NOTE: springer.com, not springerpub.com. This text is accessible as a free e-book through the Galter Health Sciences Library. Access available through SpringerLink gateway. If off-campus, first log into GHSL website—system will authenticate that you are a registered student before accessing library-licensed/subscribed online materials.

Osteroff, J. A., Pifer, E. A., Teich, J. M., Sittig, D. F., & Jenders, R. A. (2005). *Improving outcomes with clinical decision support: an implementer's guide*. Chicago, IL: HIMSS.

[ISBN 0-9761277-2-5]

## Software

None.

**Prerequisites**

None.

**Learning Goals**

The goals of this course are to:

- Analyze medical decisions for the application of pertinent clinical decision support technology.
- Evaluate IT resources needed for the implementation of decision support systems.
- Apply medical decision support interventions at appropriate points in the diagnosis and treatment continuum.
- Gain stakeholder support in leading the development of decision support interventions.
- Develop tools for the improvement of decision support technology.
- Formulate a comprehensive plan for the development, implementation, and evaluation of a decision support system.
- Promote effective use of decision support technology in a health care organization.

**Evaluation**

The student's final grade will be determined as follows:

- Clinical Guidelines and Performance Measurement Assignment 1 (Session 1): 30 points possible
- 2 x 2 Table Assignment 2 (Session 2): 30 points possible
- Decision Tree Assignment 3a (Session 3): 20 points possible
- Sensitivity Analysis Assignment 3b (Session 3): 20 points possible
- CDS System Research Assignment 4 (Session 4): 25 points possible
- Probability Revision Assignment 5 (Session 5): 25 points possible
- Intervention Selection and Workflow Opportunities Assignment 6 (Session 6): 20 points possible
- Intervention (or Content) Specification Assignment 7 (Session 7): 30 points possible
- Final Paper Assignment (Session 10): 300 points possible
- Final Proctored Exam (Session 10): 200 points possible
- Participation (DBs): 30 points per week, for a total of 300 points possible

**Total Points: 1,000 pts.**

**Grading Scale**

96%–100%=A

92%–95%=A-

88%–91%=B+

84%–87%=B

80%–83%=B-

70%–79%=C+

60%–69%=C

59% and below=F

**Session Timetable for Summer Program:**

<b>Start of Term</b>	27-Sept-12
<b>Session 1</b>	1-Oct-12
<b>Session 2</b>	8-Oct-12
<b>Session 3</b>	15-Oct-12
<b>Session 4</b>	22-Oct-12
<b>Session 5</b>	29-Oct-12
<b>Session 6</b>	5-Nov-12
<b>Session 7</b>	12-Nov-12
<b>Session 8</b>	19-Nov-12
<b>Session 9</b>	26-Nov-12
<b>Session 10</b>	3-Dec-12
<b>End of Term</b>	14-Dec-12

**Discussion Board Etiquette**

The purpose of the discussion boards is to allow students to freely exchange ideas. It is imperative to remain respectful of all viewpoints and positions and, when necessary, agree to respectfully disagree. While active and frequent participation is encouraged, cluttering a discussion board with inappropriate, irrelevant, or insignificant material will not earn additional points and may result in receiving less than full credit. Frequency is not unimportant, but content of the message is paramount. Please remember to cite all sources—when relevant—in order to avoid plagiarism.

**Proctored Assessment**

There is a proctored assessment requirement in this course. For additional information, please go to the Assignments section in Blackboard and scroll to the Proctored Exam Approval Application item.

**Attendance**

This course will not meet at a particular time each week. All course goals, session learning objectives, and assessments are supported through classroom elements that can be accessed at any time. To measure class participation (or attendance), your participation in threaded discussion boards is required, graded, and paramount to your success in this class. Please note that any scheduled synchronous or “live” meetings are considered supplemental and optional. While your attendance is highly encouraged, it is not required and you will not be graded on your attendance or participation.

**Late Work**

Late work will be accepted; however there is a 20% point penalty per day after the due date. After five days, no credit will be given.

**Learning Groups**

Learning groups are utilized in this course. More information about learning groups will be provided by the instructors via the Blackboard course site.

**Academic Integrity at Northwestern**

Students are required to comply with University regulations regarding academic integrity. If you are in doubt about what constitutes academic dishonesty, speak with your instructor or graduate coordinator before the assignment is due and/or examine the University Web site. Academic dishonesty includes, but is not limited to, cheating on an exam, obtaining an unfair advantage, and plagiarism (e.g., using material from readings without citing or copying another student's paper). Failure to maintain academic integrity will result in a grade sanction, possibly as severe as failing and being required to retake the course, and could lead to a suspension or expulsion from the program. Further penalties may apply. For more information, visit [www.scs.northwestern.edu/student/issues/academic\\_integrity.cfm](http://www.scs.northwestern.edu/student/issues/academic_integrity.cfm).

Plagiarism is one form of academic dishonesty. Students can familiarize themselves with the definition and examples of plagiarism, by visiting [www.northwestern.edu/uacc/plagiar.html](http://www.northwestern.edu/uacc/plagiar.html). A myriad of other sources can be found online.

Some assignments in this course may be required to be submitted through SafeAssign, a plagiarism detection and education tool. You can find an explanation of the tool at <http://wiki.safeassign.com/display/SAFE/How+Does+SafeAssign+Work>. In brief, SafeAssign compares the submitted assignment to millions of documents in large databases. It then generates a report showing the extent to which text within a paper is similar to pre-existing sources. The user can see how or whether the flagged text is appropriately cited. SafeAssign also returns a percentage score, indicating the percentage of the submitted paper that is similar or identical to pre-existing sources. High scores are not necessarily bad, nor do they necessarily indicate plagiarism, since the score does not take into account how or whether material is cited. If a paper consisted of one long quote that was cited appropriately, it would score 100%. This would not be plagiarism, due to the appropriate citation. However, submitting one long quote would probably be a poor paper. Low scores are not necessarily good, nor do they necessarily indicate a lack of plagiarism. If a 50-page paper contained all original material, except for one short quote that was not cited, it might score around 1%. But, not citing a quotation is still plagiarism.

SafeAssign includes an option in which the student can submit a paper and see the resultant report before submitting a final copy to the instructor. This ideally will help students better understand and avoid plagiarism.

**Other Processes and Policies**

Please refer to your SCS student handbook at [www.scs.northwestern.edu/grad/information/handbook.cfm](http://www.scs.northwestern.edu/grad/information/handbook.cfm) for additional course and program processes and policies.

## Course Schedule

**Important Note:** Changes may occur to the syllabus at the instructor's discretion. When changes are made, students will be notified via an announcement in Blackboard.

### Session 1

#### Learning Objectives

After this session, the student will be able to:

- Select appropriate evidence-based guidelines and performance measurement criteria to form business rules and decision logic for a decision support intervention.
- Discuss the advantages and disadvantages of public reporting and pay for performance systems.
- Discuss challenges faced in integrating performance measures into electronic health record (EHR) systems.

#### Course Content

##### Online Reading

1. Performance measurement for health system improvement: experiences, challenges and prospects
2. Putting Reliable Health Care Performance Measurement Systems into Practice
3. Identifying and Using Good Practice Guidelines
4. Examining the Relationship between Clinical Decision Support and Performance Measurement
5. State of the USA Health Indicators: Letter Report
6. The unintended consequences of publicly reporting quality information
7. Transformation of Health Care at the Front Line
8. Performance Measures Using Electronic Health Records: Five Case Studies

#### Discussion Board

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

#### Assignments

Assignment 1 (Clinical Guidelines and Performance Measurement) is due the Sunday October 7, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

#### Sync Session

Wednesday, October 3, 2012, 7 p.m.–9:30 p.m. (central time)

### Session 2

#### Learning Objectives

After this session, the student will be able to:

- Analyze a medical decision scenario using the PROactive approach.
- Apply the rules of probability to fill in missing data in a 2x2 table.
- Apply rules of probability to express uncertainty in numerical terms.
- Show how numerical values for uncertainty can be employed in determining the best course of action at each branch of a decision tree.

#### Course Content

##### Textbook Reading

*Hunink*, Chapters 1 – 2

##### Online Reading

1. Decision analysis in patient care
2. Optimal treatment of knee monarthrosis in juvenile idiopathic arthritis: a decision analysis

**Multimedia**

Introduction to Decision Analysis

Decision Analysis with Imperfect Information; Tree-Flipping

**Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

**Assignments**

Assignment 2 (2x2 Table) is due the Sunday October 14, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

**Sync Session**

None.

**Session 3****Learning Objectives**

After this session, the student will be able to:

- Show how the process of "rolling back" a decision tree can determine the best of several competing treatment paths.
- Explain how sensitivity analysis can determine which factors exert the greatest influence upon a decision outcome.
- Describe several tools and techniques used in valuing decision outcomes.
- Discuss the strengths and weaknesses of the various tools and techniques used in valuing decision outcomes.

**Course Content****Textbook Reading**

*Hunink*, Chapters 3 – 4

**Online Reading**

1. The diabetes mellitus medication choice decision aid: a randomized trial  
Time-tradeoff utilities for identifying and evaluating a minimum data set for time-critical biosurveillance
2. Decision analysis of medical and surgical treatments for trigeminal neuralgia
3. Simultaneous Liver Kidney Transplantation – A Medical Decision Analysis

**Multimedia**

Decision Tree Rollback and Sensitivity Analysis

Techniques for Outcome Valuation

**Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

**Assignments**

Assignment 3a (Decision Tree) & Assignment 3b (Sensitivity Analysis) are due Sunday October 21, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

**Sync Session**

None.

## **Session 4**

### **Learning Objectives**

After this session, the student will be able to:

- Explain the differences between knowledge-based and non-knowledge-based clinical decision support systems.
- Describe various approaches to knowledge representation.
- Discuss different approaches to machine reasoning.
- Identify issues that have prevented wider adoption of CDS systems.
- Discuss important factors that should be considered in CDS system design.
- Describe several systems of medical ontology.
- Propose solutions for standardizing terminology.

### **Course Content**

#### **Textbook Reading**

*Berner*, Chapters 1 & 4

#### **Online Reading**

1. Development of a clinical decision model for thyroid nodules
2. The impact of electronic health records on time efficiency of physicians and nurses: a systematic review
3. Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality
4. "e-latrogenesis": The most critical unintended consequence of CPOE and other HIT

### **Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

### **Assignments**

Assignment 4 (CDS System Research) is due Sunday October 28, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

### **Sync Session**

Wednesday, October 24, 2012, 7 p.m.–9:30 p.m. (central time)

## **Session 5**

### **Learning Objectives**

After this session, the student will be able to:

- Use a probability revision technique to calculate the probability of a disease given the result of a diagnostic test.
- Contrast online transactional processing (OLTP) with data warehousing.
- Explain how an online analytical processing (OLAP) engine can be used to generate data reports for clinical decision support.
- Contrast supervised and unsupervised learning techniques used in data mining.
- Describe several data mining techniques.

### **Course Content**

#### **Textbook Reading**

*Hunink*, Chapter 5

*Berner*, Chapters 2 – 3

#### **Online Reading**

1. OLAP Council White Paper [White Paper]
2. An overview of data warehousing and OLAP technology
3. Clinical decision support using OLAP with data mining
4. Population decision support: quality reporting through a data warehouse
5. Using data mining techniques to explore physicians' therapeutic decisions when clinical guidelines do not provide recommendations: methods and example for type 2 diabetes

**Multimedia**

Techniques for Probability Revision  
Introduction to Data Mining (from MSIS 435, Session 2)  
Six Data Mining Tasks (from MSIS 435, Session 2)  
Decision Tree (from MSIS 435, Session 2)

**Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

**Assignments**

Assignment 5 (Probability Revision) is due Sunday November 4, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

**Sync Session**

None.

**Session 6****Learning Objectives**

After this session, the student will be able to:

- Discuss federal plans for the integration of health information technology (HIT) and the potential role of CDS systems in improving quality and outcomes.
- Identify stakeholders for a proposed clinical decision support system.
- Identify potential clinical information resources for a proposed CDS system.
- Formulate high-level CDS goals, clinical goals, and clinical objectives for a proposed CDS system.
- Identify optimum points in the workflow for application of proposed CDS interventions.

**Course Content****Textbook Reading**

*Osteroff*, Chapters 1 – 3

**Online Reading**

1. Clinical decision support: progress and opportunities
2. A win-win scenario - using the electronic health record to facilitate quality improvement and achieve physician maintenance of certification
3. Clinical decision support systems: State of the Art
4. Clinical decision support more than a supplement to CPOE

**Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

**Assignments**



Assignment 6 (Intervention Selection and Workflow Opportunities) are due Sunday November 11, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

### **Sync Session**

None.

## **Session 7**

### **Learning Objectives**

After this session, the student will be able to:

- Discuss challenges that are faced in orchestrating change.
- Recommend techniques for successful change management.
- Determine potential CDS interventions for a proposed CDS system.
- Discuss approaches to CDS application planning and development.
- Formulate a plan for development and evaluation of a proposed CDS system.

### **Course Content**

#### **Textbook Reading**

*Osteroff*, Chapters 4 – 6

#### **Online Reading**

1. EMRs: reaching the holy grail
2. Managing to change: a model for cultural transformation for the accountable care organization

### **Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

### **Assignments**

Assignment 7 (Intervention [or Content] Specification) is due Sunday November 18, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

### **Sync Session**

None.

## **Session 8**

### **Learning Objectives**

After this session, the student will be able to:

- Discuss approaches to fostering CDS system usability.
- Recommend a plan for improving usability of a proposed CDS system.
- Discuss best practices for interface design.
- Debate the pros and cons of promoting patient access to medical records.
- Recommend tools that could be used to empower patients to participate in their own health care.

### **Course Content**

#### **Textbook Reading**

*Berner*, Chapter 11

#### **Online Reading**

1. Complementary methods of system usability evaluation: Surveys and observations during software design and development cycles
2. Cognitive and usability engineering methods for the evaluation of clinical information systems

3. The usability axiom of medical information systems
4. Research-based web design & usability guidelines
5. The effects of promoting patient access to medical records: a review
6. A vision for patient-centered health information systems

### **Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

### **Assignments**

None.

### **Sync Session**

None.

## **Session 9**

### **Learning Objectives**

After this session, the student will be able to:

- Discuss lessons learned from the development of a comprehensive diagnostic decision support system (ILIAD).
- Argue the pros and cons of a comprehensive approach versus situation-based interventions for diagnostic decision support.
- Discuss the successes and challenges of integrating CDS.

### **Course Content**

#### **Textbook Reading**

*Berner*, Chapters 5 & 8

#### **Online Reading**

1. Iliad as an expert consultant to teach differential diagnosis
2. Progress (?) on Clinical Decision Support  
Intermountain Healthcare – Salt Lake City, Utah, US
3. Grand challenges in clinical decision support
4. Clinical decision support capabilities of commercially-available clinical information systems
5. Final Exam Part II Reading 1: Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality
6. Final Exam Part II Reading 2: Impact of Computerized Decision Support on Blood Pressure Management and Control: A Randomized Controlled Trial

### **Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

### **Assignments**

Final Paper is due Sunday December 9, 2012 at 11:55 p.p. (central time).

### **Sync Session**

None.

## **Session 10**

### **Learning Objectives**

After this session, the student will be able to:

- No new learning objectives will be introduced in this Session.

### **Course Content**

None.

### **Discussion Board**

Each session you are required to participate in the session-specific discussion board forum. Your participation in both posting and responding to other students' comments is graded. For this session's discussion topic(s), visit the discussion board in Blackboard.

### **Assignments**

Final Exam Part (Proctored) is due Sunday December 9, 2012 at 11:55 p.m. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

### **Sync Session**

None.