



NORTHWESTERN  
UNIVERSITY

SCHOOL OF  
CONTINUING  
STUDIES

MED\_INF 406: Decision Support Systems and Health Care

Spring 2012

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Office Hours: By appointment only

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**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)*. Cambridge, England: Cambridge University Press.

Berner, E. S. (ed.). (2007). *Clinical decision support systems: Theory and practice (2nd ed.)*. 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., Teich, J. M., Levick, D., Saldana, L., Velasco, F. T., Sittig, D. F., Rogers, K. M., & Jenders, R. A. (2011). *Improving outcomes with clinical decision support: an implementer's guide*. Second Edition. Chicago, IL: HIMSS. [Please note that we will be using the new second edition which is currently only available on the HIMSS online bookstore:

<http://marketplace.himss.org/OnlineStore/FeaturedProducts.aspx>

or the Abbott Hall Bookstore:

<http://abbotthall.bkstore.com> (do not buy used or you will receive edition one).

**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 (Session 1): 30 points possible
- Decision Analysis Using the PROactive Approach Assignment (Session 2): 20 points possible
- 2 x 2 Table Assignment (Session 2): 10 points possible
- Decision Tree Assignment (Session 3): 20 points possible
- Sensitivity Analysis Assignment (Session 3): 10 points possible
- CDS System Research Assignment (Session 4): 25 points possible
- Probability Revision Assignment (Session 5): 25 points possible
- Stakeholders, Goals, and Objectives Assignment (Session 6): 10 points possible
- Information System Inventory Assignment (Session 6): 10 points possible
- Intervention Selection and Workflow Opportunities Assignment (Session 6): 10 points possible
- Change Management Plan Assignment (Session 7): 15 points possible
- Intervention (or Content) Specification Assignment (Session 7): 15 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

### Discussion Board Etiquette and Grading

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.

Discussion board participation will be evaluated as follows:

Postings should blend industry news, current events, work experiences, etc. with the week's assignments and course subjects. They should be relevant to the class and assignment topics for the week and show mastery thereof. If a student is the originator of a posting, he/she should respond to other student's questions in a timely manner. **To receive full credit (30 points) for discussion board participation each week, the requirements are as follows:**

- Provide four 'value' statements on the discussion board each week to engage classmates and stimulate peer-to-peer discussion. A value statement is generally defined as a posting that is more than a 'thank you' e-mail to another student or a posting only containing web links or attachments that also lack student perspective on the week's topic.
- At least one of the above statements should be posted by 11:59 pm central time on Wednesday of the session week. This gives other students an opportunity to respond to postings by submitting entries and questions throughout the week. It is inherently difficult for students to engage with another student if all

postings are submitted all at once towards the end of the week. **Failure to make the first post by Wednesday will result a deduction of five points from the discussion board participation score for that week.**

- Discussion for each week will end at 11:59 pm central time each Sunday evening. Given that weekly homework is also due at the same time, students are encouraged to participate earlier in the week and avoid leaving everything until the last minute.
- By the following evening (Monday) at 11:59 pm, each student is asked to email the instructor a brief account of what they consider to be the three most important things learned from the discussions of the previous week. **The summary email is worth five points of the total (30 point) discussion board grade for the week.**

### **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

Performance measurement for health system improvement: experiences, challenges and prospects  
Putting Reliable Health Care Performance Measurement Systems into Practice  
Identifying and Using Good Practice Guidelines  
Examining the Relationship between Clinical Decision Support and Performance Measurement  
State of the USA Health Indicators: Letter Report  
The unintended consequences of publicly reporting quality information  
Transformation of Health Care at the Front Line  
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 Sunday, April 1, 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

Tuesday, March 27, 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**

Optimal treatment of knee monarthritits in juvenile idiopathic arthritis: a decision analysis  
Simultaneous Liver Kidney Transplantation – A Medical 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 (Decision Analysis Using the PROactive Approach) & Assignment 3 (2x2 Table) are due Sunday, April 8, 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**

The diabetes mellitus medication choice decision aid: a randomized trial  
Decision analysis of medical and surgical treatments for trigeminal neuralgia

#### **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 4 (Decision Tree) & Assignment 5 (Sensitivity Analysis) are due Sunday, April 15, 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**

Development of a clinical decision model for thyroid nodules

The impact of electronic health records on time efficiency of physicians and nurses: a systematic review

Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality

“e-Iatrogenesis”: 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 6 (CDS System Research) is due Sunday, April 22, 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 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**

An overview of data warehousing and OLAP technology

Clinical decision support using OLAP with data mining

Population decision support: quality reporting through a data warehouse

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 7 (Probability Revision) is due Sunday, April 29, 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**

Clinical decision support: progress and opportunities

Clinical decision support systems: State of the Art

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 8 (Shareholders, Goals, and Objectives), Assignment 9 (Information System Inventory), & Assignment 10 (Intervention Selection and Workflow Opportunities) are due Sunday, May 6, 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**

EMRs: reaching the holy grail

Managing Change: An Overview

Ready, Set, Go! Creating a Repeatable People/Process EMR Activation Strategy at University Hospitals of Cleveland

### **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 11 (Change Management Plan) & Assignment 12 (Intervention [or Content] Specification) are due Sunday, May 13, 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**

Complementary methods of system usability evaluation: Surveys and observations during software design and development cycles

Cognitive and usability engineering methods for the evaluation of clinical information systems

Research-based web design & usability guidelines

The effects of promoting patient access to medical records: a review

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**

Iliad as an expert consultant to teach differential diagnosis

Progress (?) on Clinical Decision Support

Intermountain Healthcare – Salt Lake City, Utah, US

Grand challenges in clinical decision support

Clinical decision support capabilities of commercially-available clinical information systems

Final Exam Part II Reading 1: Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality

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**

None.

### **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 I (Proctored) and Final Exam Part II are due Saturday, June 2, 2012 at 11:55 p.m. (central time). Final Paper is due Sunday, June 3, 2012 at 11:55 p.p. (central time). For more information, click Assignments on the left navigation panel in Blackboard, and scroll to this assignment's item.

### **Sync Session**

None.