# Syllabus

94-706 **Healthcare Information Systems**
M, W, 10:30am - 11:50am, HBH 1001

## Instructional Staff

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## Introduction

Healthcare systems worldwide are under tremendous pressure on all fronts – cost, quality of care, access, and efficiency. Chronic disease and complex health conditions are on the increase, demand for efficient and effective care delivery is outpacing supply, and healthcare costs have reached around 18% of the GDP. In the US, the recently passed Healthcare Reform bill, the Affordable Care Act, following the recommendations of successive reports by the Institute of Medicine (IOM), has called for wide adoption of Information Technology (IT) to improve

access, efficiency and quality of care, and reduce costs. IT has emerged as a potentially powerful enabler in helping to achieve multiple goals across the healthcare eco-system.

The explosive advances in Information Technology in recent years combined with the current focus on healthcare reform has created the need for skilled individuals who can understand, develop, manage, and integrate clinical and administrative information, technologies and systems to support timely and informed decision making in organizations. Healthcare Informatics has been named one of the top careers in *U.S. News & World Report*, and the American Medical Informatics Association (www.amia.org) estimates that the nation will need 10,000 professionals trained in informatics immediately!

This course will provide a broad overview of the application of major information systems methodologies and approaches in the delivery and administration of modern healthcare systems. The development and use of decision support systems and mobile and internet based applications in the context of the Electronic Health Record (EHR) and associated clinical information systems, and enabled by interoperability and regulatory mechanisms, will be a major focus of the course.

**Audience**

The course is appropriate for graduate students who want to understand the interaction between information technology and healthcare delivery and management issues in the current healthcare arena.

**Learning Outcomes:** Students should be able to:

1. Understand and appreciate the role and value of information technologies in potentially revolutionizing healthcare delivery, administration, education, and research;

2. Distinguish the various types of healthcare information, including knowledge, data, sources, processes and standards;

3. Identify major health informatics applications and develop basic familiarity with healthcare IT products;

4. Analyze obstacles and success factors for implementation and integration of information, communication and decision technologies in healthcare;

5. Discuss the technical and policy implications of introducing informatics applications into healthcare for process efficiency and quality of care;

6. Develop teamwork skills to mediate the communication between healthcare professionals and information technology personnel;

7. Acquire hands-on experience in analyzing a problem arising from practice and implementing a solution using a health informatics approach.

**Course Structure**

This course will be taught in discussion format via instructor, guest speakers, and student presentations, case study analyses, and software demonstrations. A semester-long group project is the cornerstone of this course that provides students with hands-on experience in conceptualizing, designing and implementing healthcare information systems.

**Course Materials**

Required materials: Harvard Business School Cases and Articles

**Course link: https://cb.hbsp.harvard.edu/cbmp/access/44234472**

Weekly lectures will be posted on the blackboard site: http://www.cmu.edu/blackboard/.

Lists of recommended books, journals, magazines and articles are also available on the course website. Students will be guided to additional substantive course material on the Internet to identify issues, obtain perspectives, and gain knowledge of current uses of information technology in healthcare.

**Student Activities**

Students are expected to participate actively in class discussions,

discussion forum on blackboard, present summaries on focused topics, analyze and debate two Harvard Business School (HBS) cases, complete a midterm exam, and conceptualize, design, implement, and demo the final project - a working prototype of a healthcare decision support system application.

**Grading Criteria**

The final grade will be determined by the following evaluation components:

1. Assignments, presentations and class participation (individual and group effort): 20%

All students are expected to be fully prepared for classes. This includes completing the assigned readings and homework for each class, preparing summary and critiques of the readings as specified, exploring and presenting IT solutions on relevant topics, and being an involved discussant in class.

2. HBS case discussions (group effort): 15%

Analyze, report, present and discuss two HBS cases that will be a major component of the evaluation process.

3. Mid-term Exam: 30% (March 21)

4. Final project proposal (group effort): 5% (due March 2)

The project proposal should be a 1-page outline of the problem you intend to explore using a DSS approach. Include the motivation and context, a brief overview of the requirements that need to be addressed, and 3 DSS questions that will be answered by the IT-enabled solution. A sample proposal is available on the course Blackboard site.

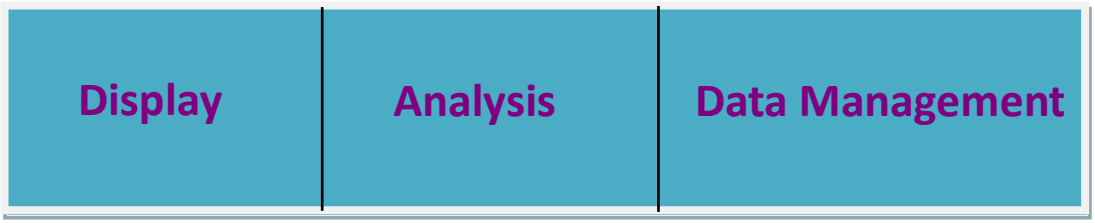
5. Final Project (group effort): 30% (due April 25)

An implementation, report, and presentation of a prototype Healthcare Decision Support System due in the final week of the semester.

The final project involves the investigation of issues associated with a specific healthcare industry problem from the perspective of a key

stakeholder: providers, patients, insurers, state and federal governments, IT vendors, or the general consumer. Examples include Meaningful Use initiatives, e-health initiatives, mobile health initiatives, ACO models, Pay for Performance (P4P), compliance reporting, claims administration, patient safety initiatives, medication management and disease management. The report should address who are the players, what is the problem, why this is a problem, what proposals have been made for resolution, what is the status of the proposal, and what is the role of IT in providing an effective decision support solution strategy for the problem. Discussion of the role of IT also requires identification of a major vendor of software products for the problem, and identification of the gaps in existing solutions to the problem.

A decision support system (DSS) can be defined as any computer system composed of data management and analysis tools, designed to support decision-making. In health care, one can broadly think of two main types of decision support systems: clinical and administrative. Clinical decision support systems help to improve delivery of healthcare by supporting health professionals make more informed clinical decisions. Administrative decision support systems help management professionals, such as finance and human resource managers, make decisions to improve management and organization of healthcare resources.




The underlying conceptual architecture of a generic decision support system consists of a presentation system, language system, problem processing system, and knowledge system (Holsapple and Whinston, 1996). The presentation and language systems comprise the user interface component of a DSS. They help the user access the system (for instance, an electronic health record) and interact with it. The knowledge system is a systematically organized collection of knowledge that is accessible electronically and interpretable by the computer. A database, data warehouse, or a medical knowledge base consisting of a vocabulary with relationships that capture the medical literature and expert domain knowledge, are examples of knowledge system. The problem processing

system provides a reasoning strategy or analytical approach to harness the knowledge system. An example is the set of drug-drug interaction rules that can be applied to a database of drugs before a transaction takes place. Patient data in the form of an electronic patient medical record makes up the final database component that triggers the rules when the patient is prescribed a new medication.

You will use the Microsoft Office suite (Word, Excel, Access, and PowerPoint) to implement a healthcare-related, desktop, decision support system. The project will include a written report (using Word), a hallway poster and presentation slides (using PowerPoint), and a prototype application (using Access and Excel), all linked to each other. The integration of all the components is an important requirement of the prototype.

The final report should include all the following components. The poster and presentation may include a relevant subset.

(1) Describe the problem and the context
(2) Describe the policy and management issues relevant to your specific problem
(3) Develop the process model underlying the problem
(4) Identify a software vendor and product which is a potential solution to the problem
(5) Discuss the gaps in existing information systems approaches and solutions to the problem
(6) Explain the major components of your IT solution and their content by mapping of the decision support requirements of the problem, including the impact of standards and HIPAA, on the technology architecture of your IT solution
(7) Describe the data sources used, and the data elements extracted from these sources
(8) Apply the PEIT framework to develop an implementation and deployment plan for your DSS application
(9) Examine the solution for "what-if" scenarios
(10) Conclusions and specific recommendations

Peer Evaluation will be included in the grading of the project.

The report, composed as a Word document in 12 point font and double

spaced, should not exceed 20 pages, including references and appendices. It should be justified on both sides and include page numbering, appropriate section titles, and references. The final in-class presentation and prototype demo by each group should not exceed about 10 - 12 minutes. Poster template and dimensions are available on Blackboard in Final Project folder.

All components should be submitted as a zipped file to the course blackboard site before April 25.

**Assignment Due Dates**

Requests for extensions of assignment due dates or for course incompletes will be granted only for medical reasons with evidence of medical need.

**Students with Disabilities**

If you have a qualifying disability, please feel free to request accommodation from the instructor. In addition, Carnegie Mellon recommends that you contact Equal Opportunity Services (EOS). Contact Larry Powell, EOS Coordinator, at 412-268-2013 or check for further information at http://www.cmu.edu/hr/eos/disability/students/index.html.

**Academic Integrity: Cheating and Plagiarism**

The Heinz College prepares students for positions of public trust, and therefore must uphold the highest standards of academic integrity. As the instructor of this course, I am committed to this principle and intend to enforce it rigorously. All work presented in this class must be accurately represented for what it is, with every source clearly identified. Creative, original thinking is valued, as is a capability to tap into the wealth of accumulated knowledge. I expect and require that submitted work be an honest representation of what each student has done. Sources found in books, magazines, newspapers and the web must be properly cited. Discussions with friends, family and fellow students must be identified. As a student in this class, you must accept responsibility for work that you submit. You are, and I expect you to be, much more than a collector of other people's ideas and expressions. Therefore, I value your independent work. You will benefit greatly from in-class discussions and discussions

outside of the classroom of topics covered in the course. Go beyond this to put your individual stamp on each thing that you do. Be fair and honest in clearly indicating what has been the source and inspiration of your work. Infractions of this policy will not be tolerated and can lead to failure of the course and dismissal from the College.

See also the "Carnegie Mellon University Policy on Cheating and Plagiarism." Students will be expected to be familiar with this policy which can be found in the Student Handbook and on the web at: http://www.cmu.edu/policies/documents/Cheating.html

Consult the "Carnegie Mellon University Academic Disciplinary Actions Overview for Graduate Students"
at: http://www.cmu.edu/policies/documents/GradDisc.html

## Schedule

This schedule is a tentative one. Topics may need to be moved around as I get confirmations from guest speakers.

Week 1 - January 11: What is Healthcare Informatics? Course Overview

Week 1 - January 13: The Case for Healthcare Informatics with Illustrative Examples

Week 2 - January 18: **Martin Luther King Day; NO CLASS**

Week 2 - January 20: Process Fundamentals: Motivation and modeling constructs; Assignment 1 due

Week 3 - January 25: Process Modeling and Analysis: Metrics and methods

Week 3 – January 27: Process Modeling and Analysis: PEIT Framework

Week 4 – February 1: Electronic Health Records (EHR): Definitions, content, and technology; Assignment 2 due

Week 4 - February 3: Electronic Health Records (EHR): Adoption and use issues;

Week 5 - February 8: Introduction to Healthcare Decision Support Systems (DSS); Computerized Physician Order Entry (CPOE); Assignment 3 due

Week 5 - February 10: Electronic Prescribing;

Week 6 - February 15: HBS Case Analysis: Case 1 report and presentation due

Week 6 - February 17: HBS Case Analysis (contd.)

Week 7 - February 22: Healthcare Data and Standards; Assignment 4 due

Week 7 – February 24: Healthcare Data and Standards (contd.)

Week 8 – February 29: DSS Lab Session; Assignment 5 due

Week 8 - March 2: DSS Lab Session; DSS Final Project Proposal due

Week 9 - March 7, 11: **SPRING BREAK - NO CLASSES**

Week 10 - March 14: Data Analytics I

Week 10 - March 16: Data Analytics II

Week 11 - March 21: **Mid-term Exam**

Week 11 - March 23: Data Management and Data Warehousing

Week 12 – March 28: DSS and Decision Making; Assignment 6 due

Week 12 – March 30: HIPAA and Health IT; Evaluation of Healthcare IT Applications

Week 13 - April 4: eHealth technologies and applications; Assignment 7 due

Week 13 - April 6: mHealth technologies and applications

Week 14 - April 11: HBS Case Analysis: Case 2 report and presentation due

Week 14 - April 13: HBS Case 2 Analysis (contd.)

Week 15 - April 18: Health IT guest panel; Assignment 7 due

Week 15 - April 20: Health Information Exchanges – Guest speaker

Week 16 – April 25: Final Project Presentation and Prototype Demo

Week 16 – April 27: Final Project Presentation and Prototype Demo

April 28: Hallway Poster Presentations & Demo

April 29: HW peer evaluations and Final project peer evaluations due