Department of Health Administration and Policy

College of Health and Human Services

Fall 2018

Syllabus	
Course information	HAP 752: Advanced Health Information Systems Online course. Uses Blackboard, class website, and email. Class website: http://hi.gmu.edu/hap752
Course placement	**(X)** Core **( )** Concentration **( )** Elective **(X)** Pre-requisite(s): HAP 700, HAP 709 (or approval of instructor) **( )** *Course(s) recommended before taking this course*:
Instructor	Robin Brewster, DNP, AGNP-BC, MS Health Informatics rbrewste@gmu.edu Office: Peterson Hall, Room 3046 Office Hours: Office hours by arrangement (email is the preferred communication method)
Course description	Provides in-depth analyses of the challenges of supporting clinical providers across all settings through information integration in electronic health records (EHR). Analyzes architectural trends, workflow redesign, and implementation strategies. Attention is given to life cycle management strategies for health information systems.
Course objectives	Upon completion of the course, students will be able to: ϒ Determine requirements to design an electronic medical record application. ϒ Develop design enhancements to support required extended functionalities. ϒ Research and review data exchange requirements to integrate healthcare information system modules. ϒ Demonstrate use of healthcare IT standards knowledge in design, development and implementation. ϒ Explain effectively the required redesign in healthcare workflows to ensure successful implementation of health care information systems. ϒ Evaluate the effectiveness of problem resolution and support systems security and privacy standards in health care information systems. ϒ Articulate the issues to interact with the vendors as needed to rectify problems that occur during the deployment process

Required textbook(s) and/or materials	No textbook is required. Required materials will be provided in class. Materials will be available at the class website: hi.gmu.edu/hap752
Course requirements	**Laptop Devices** This is a technology course and we will use electronic devices. Students need to be equipped with Laptops in order to work on practical exercises. The computers need to be running Windows 7 or later, have MS office 2010 or later, and be capable of running virtual machines. The minimum configuration is 4GB or RAM or more, 2-core processor, and at least 100GB of free space. It is recommended to have 8GM RAM. Please contact the instructor for details. Note that it is possible to run Windows on Apple computers using Boot Camp or preferably with virtualization software such as Parallels, VMWare, or VirtualBox. If you do not have a suitable computer, you can access one of computer labs at GMU campus. You can also get access to Health Informatics Learning Lab. **Partial List of Software that will be used in Class** - MS Office 2016, Excel and Access (available free to students at http://masonlive2.gmu.edu/microsoftstudentadvantage/).

	- VistA EMR system** - OpenEMR** - Weka** - MUMPS** - Virtualization software such as VMWare, VirtualBox that allow set up of a guest Windows operating system - Additional software may be discussed in the class and provided (**) will be provided in class, but is freely downloadable if you want to try before assigned in class **Teaching Learning Strategies:** The course combines lectures with learning practical data skills. Before registering for this class, students are expected to complete HAP 700 and HAP 709 – we will use technical skills obtained in the earlier courses. Most of weekly assignments, final exam, and the final project will require demonstration of both theoretical knowledge and practical skills. Students will query databases, integrate data/systems, and build technology solutions. Each week, reading material will be assigned and discussed in the following week. **Expectations: Students are responsible for assigned readings, class content, assignments and material.** Students are responsible for checking GMU email daily, including SPAM/JUNK folders. Comments and additional materials are distributed through email. Clean your mailbox weekly so it is not over quota even if you forward emails
Teaching methods	(X) Video Lectures ( ) Group work (X) Independent research ( ) Field work (X)Papers ( ) Guest speakers (X) Student presentations ( ) Case Studies (X) Assignments/Exams ( ) Class discussion ( ) Other _____
Evaluation	Participation is key to making the experience of everyone a pleasant one. For online courses, it means that you need to be engaged in self-study, interact with the instructor when needed, and complete all assignments on a timely basis (NLT 11:59 pm on the due date), ask questions about the topic, be involved in class discussions, etc. The final project is a semester-long effort that should be done individually. At the end of semester, students should submit a final project report and prepare

a video presentation. Details about the projects and sample topics will be provided. The project MUST include things covered in this course (i.e., decision support). The project deliverables are: final project, project presentation, and the actual product.

Each student is required to prepare and present one selected topic (independent from project presentation). The presentation is about 10 minutes and should be related to the class. It is recommended that the presentation be related to a paper from one of journals listed above. Online students must record a presentation that will be shared with other students in class.

The class also requires you to get involved outside the classroom. It is often beneficial to become a member of a professional organization such as HIMSS, AMIA, IHI or other local or national organizations focused on your career and related to this class. **You need to attend at least one meeting, seminar, webinar, etc. outside of classroom organization, and write a brief report about the event.** Active participation (i.e. poster presentation) is a plus. It is not sufficient to pay an organization membership fee. You need to participate in an event. Look for meetings early in the semester instead of waiting until the last moment.

Late submissions of assignments may be penalized up to 20%.

Do not copy-and-paste, do not use responses from other students or own responses from other courses. All assignments and projects are checked for plagiarism using SafeAssign. Plagiarism will be reported and handled according to GMU policies.

Grading Scale

Final grade is calculated based on percentages provided below. If at any time during the semester you are not aware of your partial grades, contact your instructor. The process is transparent, and the calculation is done using the formula.

Distribution of the grade		**Letter grades will correspond to the following numerical grades:**
Take home final exam	25%	
Informatics Topic Presentation	20%	96+ A
Weekly assignments	20%	90-95 A -
		86-89 B +
Participation in a professional organization	5%	74-85 B
		70-74 C
Semester long project	25%	70- F
Participation in discussions	5%	

	The final exam may be waived by the instructor based on very good results of research presentation, project, and assignments. This is decided on an individual basis after all other requirements are completed.
Mason Honor Code	The complete Honor Code is as follows: *To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code:* **Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.** *(From the 2014-15 Catalog – catalog.gmu.edu)*
Individuals with Disabilities	The Office of Disability Services (ODS) collaborates with students with documented disabilities and faculty to provide reasonable accommodations, auxiliary aids, and support services that are individualized and based upon medical documentation, functional limitations, and a collaborative assessment of needs. In order to receive accommodations, students must complete the following process: http://ods.gmu.edu/students/services.php *(From the 2015-16 Catalog – catalog.gmu.edu)*
E-mail Policy	Web: masonlive.gmu.edu Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly. Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service. *(From the 2015-16 Catalog – catalog.gmu.edu)*

Tentative Course Schedule

The below schedule and covered topics may be changed to reflect students' needs, cancelations, or updates based on new trends in health information systems. The assignment questions are for information purposes only. Complete questions and instructions will be provided weekly. The schedule is subject to change.

Each week specific instructions will be emailed and/or posted on blackboard.

Week	Date	Topic/Assignment
1	8/27	Introduction to Health Information Systems
Assignment due 9/9		1. What is the difference between data, information and knowledge? 2. What are the things that computers are better at than people? 3. What makes some health information systems more advanced than others? 4. Think about your semester-long project. Provide initial idea. 5. Select topic and date for your in-class presentation

2	9/3	Review of IT Infrastructure, Cloud computing
Assignment due 9/9		1. List at least four reasons for running an operating system within a virtual machine on your desktop computer. 2. What types of devices can be virtualized in computer systems? 3. What are three types of models of cloud computing? Briefly describe them. 4. Imagine that you are a consultant asked to help a clinic with 10 physicians and 40 other clinical staff. The clinic asked you to evaluate potential vendors for cloud-based solution for their computer systems (EMR, CPOS, Billing, ...). How would you approach the problem? What are important factors to be considered? Would you suggest cloud-based solution or rather advise the clinic to host own systems? 5. Download and install virtualization software (VirtualBox, VMWare Player/Fusion, Parellels....). Get a copy of operating system from DreamSparc (i.e. Windows 7), or Linux (i.e., Ubuntu, or CentOS), or something else. Try to configure a virtual machine and install the guest operating system. 6. Prepare initial requirements specification for your semester-long project. Create at least two hypothetical scenarios describing use of what you are developing. 7. Read provided articles.
3	9/10	Electronic Medical Records, Part 1
Assignment due 9/16		1. List differences between paper-based and computer-based records 2. What are the most important components of an EHR 3. Download and Install OpenEMR 4. Insert data for 4-5 patients, including notes, visits, etc. (send some screenshots) 5. Export the inserted patient data and open in Excel (send screenshots) 6. Refine your scenarios to describe all expected uses of your semester-long project: Create use cases diagrams illustrating the functional requirements of the project. In this assignment you should create scenarios and use cases for all features of the system that you want to implement. In the following steps, you will need to design the solution and implement a prototype. 7. Read provided articles.
4	9/17	Electronic Medical Records Part 2, MUMPS
Assignment due 9/23		1. Briefly describe architecture of VistA EMR 2. What are reasons for MUMPS being popular in healthcare applications? List some ideas. 3. Using MUMPS language, create a simple hierarchical database equivalent to the following two tables: Patient ID AAA-123 BB-17 AA-28 First John Brad Clint Last Smith Pitt Eastwood DOB 1/1/1970 1/2/1960 12/12/1950 SSN 111-11-1111 222-22-2222 333-33-3333 4. Define all data/information that will be stored in, processed by, or created by your system in semester-long project. Present the information as a table consisting if the following columns: Name of the field, type of the field, source of data, intended use of the data, detailed description 5. Read provided articles.
5	9/24	Healthcare Programming, MUMPS
Assignment due 9/30		1. Install VistA 2. Open CPRS and play with options 3. Login to the VM terminal, open MUMPS interface, list a few first values in the

		global that keeps VistA's patients' data 4. In FileMan, list name, ssn, sex, provider 5. Using FileMan schema browser (http://livevista.caregraf.info/schema) find a way to check if a provider is an M.D. Using what you discovered, check credentials of providers in FileMan. 6. If you enter data in your VistA installation, will you see it using the schema browser http://livevista.caregraf.info/schema? Explain why. 7. In your semester-long project, finalize list of all information processed by the system. Remember to include all information, not only what is stored. Base your response on scenarios and use cases which define who the system is used. Provide all details needed for implementation and use of the system.
6	10/1	Data Exchange
Assignment due 10/7		1. Describe at least five reasons why health information exchanges are important. 2. Describe at least five reasons why HIEs are hard to achieve and very slowly adapted. Is it different for smaller practices, larger hospitals, clinics and health systems? 3. In your opinion, what is the best way to improve adoption of HIEs? 4. ONC along with other government agencies created CONNECT, that is freely available to all industry. Why CONNECT is not used widely, and only some HIE providers use it? Do not limit your answers to what we covered in the lecture, but include analysis of provided literature and any other resources. Do not simply list reasons, but explain them. 5. For the semester-long project: - If your project involves creation of database, create a complete ER diagram (note the question is asking for diagram, not list of tables / relations). - Specify all terminologies/dictionaries that will be used for coding data in your project. Check how to obtain the terminologies (in the project you should use real terminologies, not simply say that something is an ICD-9, etc.) - Specify all sources of data/information/knowledge. For example, if your system will display explanation about abnormal blood test results, you should say precisely where the information will come from (pubmed, medline, other sources) When sending your answer, please send a brief reminder what the project is about, who are group members, etc. Also, if it is a group project, I'd like to receive the answer from all group members, even if the content is the same - it will make the grading much easier. 6. Read provided articles.
7	10/8	Personal Health Records, Virtual and Online Health Communities, Other Healthcare Information Systems
Assignment due 10/14		1. Describe differences between: - Electronic Medical Record - Personal Health Record - Electronic Medical Record - Patient Portal 2. What are potential benefits of PHRs? Do not limit your answer to list, but provide discussion of your answers. 3. In 2-3 paragraphs, discuss privacy issues related to PHRs 4. What are limitations of PHRs? Why adoption and use among patients are so low? 5. Register to a PHR provider (Healthvault, MyHealthieVet, mymedicalrecords.com. etc.) and explore its options, try to put in some data, etc. (Note: most of the systems are free, you also do not need to provide sensitive information if you don't want to). Send screenshots. 6. Read provided articles

8	10/15	Knowledge Representation Part 1 Review of logic

Assignment due 10/21		1. When the following are true?
		(here we use ~ - negation, v – disjunction, & - conjunction, -> - implication)
		p & ~p v q
		~(p v q) = ~p & ~q
		~(p -> ~p)
		2. Suppose you have a male patient who is 27 years old, weights 150, and his height is 55. Which alert will be produced by the rule below?
		IF age < 50 OR weight < 120 THEN
		ALERT 1
		ELSE IF weight/height > 3 AND age > 27
		ALERT 2
		ELSE
		ALERT 3

9	10/22	Collaborate Discussion on Projects (Synchronized)
10	10/29	Knowledge Representation Part 2
Assignment due 11/4		1. What types of nodes are typically used in ontologies? 2. Suppose you are asked to create a database structure to keep a simple ontology. The ontology will include four types of nodes N1, N2, N3, and N4. It will also include three types of relations R1, R2, and R3. There may be many nodes of each type. There may be many relations of each type. Each node is described by its type, label, and two attribute A1, A2. Each relation has type and label. - how many tables are needed to model such ontology in a relational database? - how would you extend your database to keep unlimited number of attributes for each node? - show tables in that updated database. HINT: You do not need to implement the database, it is sufficient that you list tables, fields inside, and how they are related. 3. What are potential difficulties of going from: - published evidence to clinical guidelines? - clinical guidelines to medical logic modules? 4. Why it is important to keep medical knowledge stored in knowledge base, rather than hard-coded in CDSS implementation? 5. What are the most typical forms of knowledge used in CDSS systems? 6. Read provided articles
11	11/5	Clinical Decision Support, Computable Guidelines, GLIF
Assignment due 11/11		1. Describe difference between forward- and backward chaining algorithms. Which algorithm is better? When? 2. Describe barriers in CDS implementation. 3. Consider the following rule from MYCIN: PREMISE: ($ AND (SAME CNTXT GRAM GRAMNEG)(SAME CNTXT MORPH ROD)(SAME CNTXT AIR ANAEROBIC)) ACTION: (CONCLUDE CNTXT IDENTITY BACTEROIDES TALLY.6) Suppose that gram stain of the organism is gramneg (0.9), morphology of the organism is rod (0.58), and aerobicity of the organism is anaerobic (0.92). Is the organism is bacteroides? How strong is the evidence?

		NOTE: the rule is in original MYCIN format in Lisp. There is an AND between all three conditions in the premise. In this notation (AND a b c) is a conjunction of a, b and c. 4. Describe the difference between alerts and reminders. 5. What is the role of infobutton manager? Describe what the manager does and argue about its importance. 6. Read provided articles. Additional reading in Greens, 2007. 7. Describe process of creating computable medical guidelines 8. Code a simple guideline in GLIF (text of the guideline will be provided) 9. Describe the relationship between GLIF and ARDEN 10. Describe at least five benefits and five barriers for sharing computable clinical knowledge. Reading: http://www.journals.elsevier.com/journal-of-biomedical-informatics/virtual-special-issues/computer-interpretable-clinical-guidelines/
12	11/12	Intelligent Information Systems in Healthcare
Assignment due 11/18		1. What is AI? Why it is important in healthcare? 2. List and characterize key problems considered in AI. 3. Which is the most difficult: analyzing text, analyzing speech, or analyzing databases? Why? 4. In your opinion, which of the AI technologies have the highest potential of having impact in ambulatory settings? 5. For your semester-long project: a. Prepare a brief update on the status of tour project (2-3 paragraphs) b. Prepare draft of the final report. The document does not need to be complete, but should include all sections that will be filled in with content. Suggested sections of the document are: (1) Introduction - here describe purpose of the system (2) Requirements specification - use cases, scenarios, information needs, etc. (3) Design - this is the main section that describes how the thing actually works (4) Implementation - describe how you implemented your system/prototype (5) Full system specification - describe how to go from your prototype to he full commercial product (6) Conclusion (7) Team member contributions - describe exactly who did what in team These sections are only a suggestion. You don't need to have all content for this assignment, simply start filling in the report. 6. Read assigned articles
13	11/19	Data Mining and Knowledge Discovery in Healthcare
Assignment due 12/2		1. Why machine learning and data mining are important in clinical and administrative settings? 2. Suppose you are a consultant asked to help create a computational model for assessing if patients have risk of developing secondary complications after a surgery. How would you approach the problem? What types of data are needed? What type of machine learning/data mining process is required? 3. Download and install iAQ software from www.mli.gmu.edu - Run the software and see if it finds rules that you think about. - How do you think the program discovers the rules? 4. Install Weka software

		5. Read assigned articles
14	12/3	Final Project Presentations
Videos due to Blackboard NLT 11:59 pm 12/7		Each student will record a 10-15 minute video presentation on their final project. The presentation should include problem statement, proposed solution, methodology and conclusions. Presentations may include Powerpoint slides, live demonstrations, etc. Final projects are due before the project presentations.
15	12/10	**Final Exam Assigned (due 12/15)**
The take-home exam will cover both theoretical questions and practical tasks to be completed. The exam is expected to take about 3 hours to complete.		