BMI 510/610 – Introduction to Biomedical & Health Informatics

William Hersh, M.D., Course Director
BMI 510/610: 3 credit hours
Winter Quarter, 2019
Last updated: October 29, 2018

PREREQUISITES

Graduate-level standing.

COURSE DESCRIPTION

This course provides a broad survey introduction to biomedical and health informatics, the field concerned with the acquisition, use, and storage of information in healthcare, biomedical research, and public health. Students focus on the underlying themes of biomedical and health informatics, including the proper use of information technology in health-related settings. The course provides a broad understanding of the field from the vantage point of those who implement, lead, and develop IT solutions for improving health, healthcare, public health, and biomedical research. It provides up-to-date details on current events in the field, including electronic health records, data standards and interoperability, clinical decision support, healthcare data analytics, population health, patient engagement, and telemedicine. It also describes and sets the context for new technologies, such as SMART on FHIR, wearables, and blockchain.

INSTRUCTOR

The instructor for the course is William Hersh, MD. The best way to reach him is via email (hersh@ohsu.edu). Dr. Hersh does not keep regular office hours but phone calls or meetings can be arranged with him. He also maintains a blog, Informatics Professor.

COURSE COORDINATION

Course units are released every Wednesday and all materials (including quizzes) are due one week later on the following Wednesday. The due date in Sakai is the set due date.

The course is taught via distance learning. Teaching modalities include:

- Access to the entire course via the OHSU Sakai system
- Voice-over-PowerPoint lectures using the Flash browser plug-in
- Handouts of PowerPoint slides and cited references
- Reading assignments in the form of PDFs
- On-line multiple-choice homework assignments
- On-line discussion in the Sakai forums

COURSE INTERACTION
The course aims to provide a great deal of interaction among the faculty, students, and teaching assistants. On-line discussion begins for each unit with the instructor posing 2-3 questions per unit. Students are also encouraged to post questions or comments about any topic in the course or the field in the general discussion forum at any time. The instructor aims to guide and fill in details of the discussion but not dominate it.

COURSE PROJECT

The course project is a term paper. The goal of the term paper is for you to explore a topic of interest beyond what we cover in class. Therefore, you should pick a topic that interests you, search for information about it in reputable sources, and write it up in a coherent and readable manner. You must not simply re-hash material we cover in class.

One of the big challenges students face with this assignment is an appropriate level of focus. You may need to do some searching to determine what that level of focus is. You want a topic that you can reasonably describe, not necessarily in exhaustive detail, in 10-15 pages. If you have questions about appropriate level of focus, or any other questions, do not hesitate to email the instructor. He and you can even talk by phone if necessary.

Some logistical details about the paper:

- It should be 10-15 pages double-spaced, including tables and figures but not title page or references, with one-inch margins.
- It should have a title page, which is not included in the paper page count.
- References can be in any format (e.g., APA, Vancouver) as long as they are consistent and have enough information for them to be located, and are not include in the paper page count.
- The text should be your own words and not copied and pasted from other writings. (An on-line plagiarism-checking tool is used.)
- It should be typed into a Microsoft Word document. Other word processor formats or PDF are not acceptable.
- The file name should begin with your last name, e.g., Hersh-BMI510.docx, and be uploaded to the Submission site on Sakai (do not email it).

The rubric for grading the paper is as follows. Grading for the paper is a letter grade based on all of the following criteria (percentage for each criterion):

- Title that briefly describes what paper is about (5%)
- Introductory 1-2 paragraphs that describe what will be covered in the paper (15%)
  - Provide clear and complete definition of the problem or issues of interest
- Body of paper that provides (35%)
  - Literature and perspectives relevant to background of the clinical, system, or organizational problem, and/or ethical, or policy issue
  - Discussion of issues and implications reflecting integration and analysis
  - Potential solutions/approaches/services/programs
  - Approaches and solutions grounded in the scientific literature or credible technical reports
- Concluding 1-2 paragraphs that review what was covered and provide any conclusions (15%)
• All writing in concise and grammatically correct English (20%)
  o Body of paper appropriately segmented by headings covering the main aspects of
    the paper
  o Text should be readable narrative and not a series of lists or bulleted items
  o All facts should be appropriately cited with the full reference in the Reference
    section at the end of the paper
• References can be in any format (e.g., APA, Vancouver) as long as they are consistent and
  have enough information for them to be located (which the instructor occasionally does,
  since you may pique his interest!) (10%)

WHEN PROBLEMS ARISE

It is critical to contact the appropriate person when problems arise:
• For basic Sakai problems and course issues (e.g., cannot log in, after-hours technical
  assistance, Course Materials or Forum not available/accessible during regular business
  hours/days), contact the Sakai Help Desk: Toll-Free - (877) 972-5249; email -
  sakai@ohsu.edu. Sakai help is available M-F from 8am to 9 pm and weekends from Noon
  to 5pm.
• For questions about course content (e.g., do not understand a topic or disagree with
  homework quiz answer), contact the Teaching Assistant, who will be announced at the
  beginning of the course: go to the Email Tab after logging into the course and choose
  “Associate” role to send message to the TA or post a question in the Forums.

When appropriate, all issues will be elevated to Dr. Hersh. While Dr. Hersh does not maintain
scheduled office hours, he is readily accessible via email and will respond within 24-48 hours.
Appointments to discuss course matters by phone or in person can be arranged via email.

FINAL EXAMINATION

BMI 510/610 requires a final exam. The exam is open-book, so students may access books, notes,
lectures, and the Internet but may not contact or communicate with other humans. The exam
consists of about 8 general questions, each with sub-questions, for a total of about 33 items to
answer. The items require a short answer, typically less than a sentence. The coverage of items is
similar to what is covered in the weekly quizzes, with the aim of applying the information that
has been learned. The exam is administered via Sakai during a one-week period the day that Unit
10 is posted.

It is OHSU policy that any exam offered online and worth more than 10% of the final course
grade must be virtually proctored. In this course, we will be using the services of Examity,
a remote proctoring services company. You will be required to schedule your exam three
(3) weeks ahead of time. There is no cost to the student. More information will be provided
to you regarding setup, scheduling, and requirements in the Course Materials.

Policy number: 02-70-050 (http://www.ohsu.edu/xd/education/student-services/academic-
programs-and-assessment/academic-policy/approved-policies/upload/Online-Exam-
Proctoring-02-70-050.pdf)
CURRICULUM AND DATES

Below is the outline for the course, with the unit name, reading assignment, and date the material is posted. All work in all units is due one week after it is posted (i.e., when the next unit's material is posted).

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Date Posted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview of Field and Problems Motivating It</td>
<td>1/9</td>
</tr>
<tr>
<td>2</td>
<td>Biomedical Computing</td>
<td>1/16</td>
</tr>
<tr>
<td>3</td>
<td>Electronic and Personal Health Records</td>
<td>1/23</td>
</tr>
<tr>
<td>4</td>
<td>Standards and Interoperability</td>
<td>1/30</td>
</tr>
<tr>
<td>5</td>
<td>Advancing Care With the EHR</td>
<td>2/6</td>
</tr>
<tr>
<td>6</td>
<td>Healthcare Data Analytics</td>
<td>2/13</td>
</tr>
<tr>
<td>7</td>
<td>EHR Implementation and Evaluation</td>
<td>2/20</td>
</tr>
<tr>
<td>8</td>
<td>Information Retrieval (Search)</td>
<td>2/27</td>
</tr>
<tr>
<td>9</td>
<td>Imaging Informatics and Telemedicine</td>
<td>3/6</td>
</tr>
<tr>
<td>10</td>
<td>Research Informatics (Term paper due)</td>
<td>3/13</td>
</tr>
</tbody>
</table>

The term paper is due by 5 pm Pacific time on 3/13/19. The final exam must be completed by 5 pm Pacific time 3/18/19.

REQUIRED READINGS

The course has no required textbook. Students are provided assigned readings from 1-3 key articles or reports for each unit. Students are also provided comprehensive lists of references for topics covered in the lectures.

There is an optional textbook (co-edited by the course instructor) that students may want to consider: Hoyt RE, Hersh WR, Eds. (2018). *Health Informatics: Practical Guide, Seventh Edition*, which is available from Lulu.com in eBook and paper versions. The reading assignments from the book are optional, and no material will appear on the homework quizzes or final exam that is not also covered in the class. But some students prefer to also read a textbook when learning. The appropriate chapter readings for each unit in the course are as follows:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Textbook Chapter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview of Field and Problems Motivating It</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Biomedical Computing</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Electronic and Personal Health Records</td>
<td>2, 4</td>
</tr>
<tr>
<td>4</td>
<td>Standards and Interoperability</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Advancing Care With the EHR</td>
<td>6, 8, 9</td>
</tr>
<tr>
<td>6</td>
<td>Healthcare Data Analytics</td>
<td>7, 14</td>
</tr>
<tr>
<td>7</td>
<td>EHR Implementation and Evaluation</td>
<td>10, 12, 19</td>
</tr>
<tr>
<td>8</td>
<td>Information Retrieval (Search)</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>Imaging Informatics and Telemedicine</td>
<td>16, 17</td>
</tr>
<tr>
<td>10</td>
<td>Research Informatics</td>
<td>18, 20</td>
</tr>
</tbody>
</table>

EVALUATION

Student grading is based on the following:
• On-line multiple-choice homework assignments - 30%
• Term paper - 30%
• Final examination - 30%
• Class participation in discussion forums - 10%

The course is graded on a curve, but usually adheres to the following distribution:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90-100</td>
</tr>
<tr>
<td>A-</td>
<td>85-89</td>
</tr>
<tr>
<td>B+</td>
<td>80-84</td>
</tr>
<tr>
<td>B</td>
<td>75-79</td>
</tr>
<tr>
<td>B-</td>
<td>70-74</td>
</tr>
<tr>
<td>C+</td>
<td>65-69</td>
</tr>
<tr>
<td>C</td>
<td>60-64</td>
</tr>
<tr>
<td>D/F</td>
<td>&lt;60</td>
</tr>
</tbody>
</table>

Graduate Studies in the OHSU School of Medicine is committed to providing grades to students in a timely manner. Course instructors will provide students with information in writing at the beginning of each course that describes the grading policies and procedures including but not limited to evaluation criteria, expected time needed to grade individual student examinations and type of feedback they will provide.

Class grades are due to the Registrar by the Friday following the week of finals. However, on those occasions when a grade has not been submitted by the deadline, the following procedure shall be followed:

1) The Department\(^1\)/Program Coordinator\(^2\) will immediately contact the Instructor requesting the missing grade, with a copy to the Program Director and Registrar.
2) If the grade is still overdue by the end of next week, the Department\(^1\)/Program Coordinator\(^2\) will email the Department Chair directly, with a copy to the Instructor and Program Director requesting resolution of the missing grade.
3) If, after an additional week the grade is still outstanding, the student or Department\(^1\)/Program Coordinator\(^2\) may petition the Office of Graduate students for final resolution.

\(^1\) For courses that are run by a specific department.

\(^2\) For the conjoined courses (course number is preceded by CON_ that are run by Graduate Studies.

**DETAILED COURSE OUTLINE**

1. Overview of Field and Problems Motivating It
   1.1 What is Biomedical and Health Informatics?
   1.2 A Discipline Whose Time Has Come
   1.3 Problems in Healthcare Motivating Biomedical and Health Informatics
   1.4 Who Does Biomedical and Health Informatics?
   1.5 Seminal Documents and Reports
   1.6 Resources for Field – Organizations, Information, Education

2. Biomedical Computing
   2.1 Types of Computers
2.2 Data Storage in Computers
2.3 Computer Hardware and Software
2.4 Computer Networks
2.5 Software Engineering

3. Electronic and Personal Health Records (EHR, PHR)
3.1 Clinical Data
3.2 History and Perspective of the Health (Medical) Record
3.3 Definitions and Key Attributes of the EHR
3.4 Benefits and Challenges of the EHR
3.5 EHR Examples
3.6 Personal Health Records

4. Standards and Interoperability
4.1 Standards and Interoperability: Basic Concepts
4.2 Identifier and Transaction Standards
4.3 Message Exchange Standards
4.4 Terminology Standards
4.5 SMART on FHIR

5. Advancing Care With the EHR
5.1 Patient Safety and Medical Errors
5.2 Clinical Decision Support (CDS)
5.3 Healthcare Quality Measurement and Improvement
5.4 Computerized Provider Order Entry (CPOE)
5.5 Health Information Exchange (HIE)
5.6 HITECH and Meaningful Use

6. Healthcare Data Analytics
6.1 Data Science and Data Analytics
6.2 Machine Learning
6.3 Natural Language Processing
6.4 Evidence-Based Medicine
6.5 Clinical Practice Guidelines
6.6 Population Health

7. EHR Implementation and Evaluation
7.1 Clinical Workflow Analysis and Redesign
7.2 EHR System Selection and Implementation
7.3 Privacy and Security
7.4 Nursing Informatics
7.5 Public Health Informatics
7.6 Consumer Health Informatics
7.7 Evaluation of the EHR

8. Information Retrieval (Search)
8.1 Information Retrieval
8.2 Knowledge-based Information
8.3 Content
8.4 Indexing
8.5 Retrieval
8.6 Research: Evaluation and Future Directions

9. Imaging Informatics and Telemedicine
9.1 Imaging in Health Care
9.2 Modalities of Imaging
9.3 Digital Imaging
9.4 Telemedicine: Definitions, Uses, and Barriers
9.5 Efficacy of Telemedicine

10. Research Informatics
10.1 Clinical Research Informatics
10.2 Translational Bioinformatics
10.3 Overview of Basic Molecular Biology
10.4 From Clinical Genetics and Genomics to Precision Medicine
10.5 Genomics Data in the EHR and Other Information Systems

ACADEMIC HONESTY

Course participants are expected to maintain academic honesty in their course work. Participants should refrain from seeking past published solutions to any assignments. Literature and resources (including Internet resources) employed in fulfilling assignments must be cited. See http://www.ohsu.edu/xd/education/library/research-assistance/plagiarism.cfm?WT_rank=1# for information on code of conduct for OHSU and http://www.ohsu.edu/xd/education/teaching-and-learning-center/for-students/index.cfm for more information on citing sources and recognizing plagiarism.

In an effort to uphold the principles and practice of academic honesty, faculty members at OHSU may use originality checking systems such as Turnitin to compare a student’s submitted work against multiple sources. To protect student privacy in this process, it will be necessary to remove all personal information, i.e. student name, email address, student u-number, or any other personal information, from documents BEFORE submission.

STUDENT ACCESS

OHSU is committed to providing equal access to qualified students who experience a disability in compliance with Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990, and the ADA Amendments Act (ADA-AA) of 2008. If you have a disability or think you may have a disability (physical, sensory, chronic health, psychological or learning) please contact the Office for Student Access at (503) 494-0082 or studentaccess@ohsu.edu to discuss eligibility for academic accommodations. Information is also available at www.ohsu.edu/student-access. Because accommodations may take time to implement and cannot be applied retroactively, it is important to have this discussion as soon as possible. All information regarding a student’s disability is kept in accordance with relevant state and federal laws.
COMMITMENT TO EQUITY AND INCLUSION

OHSU is committed to creating and fostering a learning and working environment based on open communication and mutual respect. If you encounter sexual harassment, sexual misconduct, sexual assault, or discrimination based on race, color, religion, age, national origin or ancestry, veteran or military status, sex, marital status, pregnancy or parenting status, sexual orientation, gender identity, disability or any other protected status please contact the Affirmative Action and Equal Opportunity Department at 503-494-5148 or aaeo@ohsu.edu. Inquiries about Title IX compliance or sex/gender discrimination and harassment may be directed to the OHSU Title IX Coordinator at 503-494-0258 or titleix@ohsu.edu.

Please use professional etiquette when communicating with peers and the instructor. This means avoiding aggressive or offensive language, showing respect for others’ opinions and positions, and conducting yourself as if you were face to face with them. Please pay special attention to etiquette in class forums and when using email. If you notice someone violating this policy, please make the instructor and TA aware of the problem.

COURSE ACCESS

Every reasonable effort has been made to protect the copyright requirements of materials used in this course. Class participants are warned not to copy, audio, or videotape in violation of copyright laws. Journal articles will be kept on reserve at the library or online for student access. Copyright law does allow for making one personal copy of each article from the original article. This limit also applies to electronic sources.

To comply with the fair use doctrine of the US copyright law, Sakai course sites close three weeks after grades are posted with the Registrar. Please be sure to download all course material you wish to keep before this time as you will have no further access to your courses.

DMICE COMMUNICATION POLICY

1. If the syllabus directs the student to contact the TA before contacting the instructor, the student should do so. Otherwise, the student should contact the instructor and allow 2 business days (not including weekends) for a response.
2. If the student does not receive a response from the instructor within 2 business days, s/he should contact the TA (if there is one). When contacting the TA s/he should cc the instructor and Diane Doctor at doctord@ohsu.edu.
3. If a student does not receive a response from the TA within 1 business day (not including weekends), s/he should contact Diane Doctor at doctord@ohsu.edu and cc the instructor and the TA.
4. If Diane does not reply within 1 business day (not including weekends), the student should contact Andrea Ilg at ilgan@ohsu.edu.
5. Students having difficulties with Sakai should contact the Sakai Help Desk at sakai@ohsu.edu or at (877) 972-5249. Sakai help is available M-F from 8am to 10-pm and weekends from Noon to 5pm. Do not contact the instructor.
DOWNLOADING COURSE CONTENT

Students are encouraged to download and save course content all class content that is made available for downloading in Sakai (PDF and MP3 files) while you are taking the class if you think you will want to refer to it later, since we will not able to provide access after the course has closed. This is especially important for PhD students who will need to review content prior to taking the qualifying exam.