SYLLABUS

MIE 290H: Infections and Social Determinants: Simulation Modeling for Disease Prevention

Spring 2016

Instructor:

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Class Schedule and Location

TuTh: 4:00 - 5:15 PM LGRC A210

Office Hours

Tu: 1:00 – 3:00 PM, Marston 120D

Course Description

This General Education course addresses fundamental questions, ideas, and methods of analyses in the social and behavioral sciences with relevance to the area of public health. It introduces students to the cultural, social and behavioral factors that impact disease epidemiology and transmission of communicable diseases, that are determinants of diseases, and that effect health inequities. It introduces students to systems thinking and systems simulation modeling in disease prevention. As an approach to problem solving, systems thinking is the process of understanding how things influence one another within a whole. Systems simulation modeling is application of systems thinking for quantitative evaluation of interventions and development of strategies for disease prevention. This course engages students in creative, analytical, and critical thinking through inquiry into the underlying causes of health inequity and barriers to disease prevention; problem solving by simulation of short- and long- term impacts of multiple intervention strategies; and synthesis of findings to help in decision-making. The course will expose students to the challenges in prevention of diseases such as HIV, TB, and malaria. Through reading and writing assignments students will learn about the drivers of these diseases, including social determinants and health inequities, and how they vary among populations within the same country and across countries. Understanding these differences will create awareness among students about the need for pluralistic perspective thinking in decision-making. Students will learn to use simulation modeling for economic analysis that can inform national strategies of disease prevention.

Course Goals

Social, behavioral, and environmental conditions are determining factors in people’s risk of illness. Systems simulation models that incorporate these determinants will provide a holistic systems thinking approach to analyzing alternative disease intervention strategies. These analyses can inform public health policy. Students in this class will learn about social determinants of health, systems thinking for disease prevention, the dynamics of infectious
disease transmission, and how to construct simple simulation and decision-tree models to inform public policy.

Course Objectives

- Students will demonstrate knowledge of the fundamental questions and ideas of the social, behavioral, cultural, and environmental determinants of diseases and health inequities, disease epidemiology and transmission of communicable diseases, and the role of systems thinking and simulation modeling in disease prevention.
- Students will apply critical thinking to understand the similarities and differences in determinants of health in high-income countries compared to low- and middle-income countries.
- Students will learn the role of simulation modeling in analyzing disease intervention strategies, understand the systems approach to disease prevention, build simple simulation and decision-tree models in Netlogo/Excel, and apply these methods to real world problems:
  - Learning about the Millennium Development Goals that aim to achieve elimination of poverty and hunger through a systems approach to addressing these interacting elements that drive diseases and impact economies.
  - Evaluating the impact and cost-effectiveness of what-if scenarios using simulation models.
  - Conducting economic analysis of simulation results and interpreting their cost-effectiveness.
- Students will learn to communicate their findings persuasively and effectively in simple language to a wider audience to inform public policy.

Software: Excel and Netlogo. Netlogo is a free, user-friendly software that requires no computer programming background and allows exploration of emergent patterns.

WebPage: We will use Moodle for viewing and submission of assignments, and grades.
Grading Criteria

- Reading assignments (4) and 1 book reading (30%)
- Modeling assignments (2) (40%)
  - All assignments will include reading components, either case studies or country reports, to understand the determinants of the disease they are modeling and include one or two factors in the model. Students will submit written reports of 5-8 pages each assignment summarizing their initial findings, methods used to evaluate decision strategies, and critical analysis and discussions of modeling results.
- Term project (30%)
  
Intervention analysis of malaria: understanding the determinants of malaria; the current rates in different current; methods for prevention; modeling multiple what-if scenarios of interventions and extracting impact and cost measures; conducting cost-effectiveness analyses; writing an 8-10 page report, which will include description of the issue, analyses questions, scenarios modeled, outcome measures, results, critical analyses of results, and conclusions; short summary of findings as a 1-page policy brief; present a summary of findings to the class in a 15-minute presentation.

Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Details</th>
<th>Assignments – week assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 19th, 21st</td>
<td>Classroom exercise to demonstrate transmission of flu</td>
<td>Reading 1 Book Reading</td>
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<tr>
<td>2</td>
<td>Jan 26th, 28th</td>
<td>Introduction to dynamic simulation modeling (compartmental and agent-based model). Construction of Ebola outbreak as agent-based model</td>
<td>Reading 2 Model 1</td>
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<tr>
<td>3</td>
<td>Feb 2nd, 4th</td>
<td>Continuing construction of simulation model: prompting application of systems thinking knowledge during model development; identifying and incorporating key determinants into the model for quantitative analysis;</td>
<td>Reading 3</td>
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<tr>
<td>4-5</td>
<td>Feb 9th, 11th, Feb 18th (16th no class)</td>
<td>Model assignment 1 Cost-effectiveness analysis; Model verification; Model validation</td>
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<td>5-7</td>
<td>Feb 23rd, 25th</td>
<td>Simulate outbreak of measles as compartmental.</td>
<td>Model 2</td>
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<td>8</td>
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<td>9-13</td>
<td>March 22nd, 24th, March 29th, 31st, April 5th, 7th, April 12th, 14th, April 19th</td>
<td>Malaria intervention analysis (Project) Use the approach to disease prevention demonstrated in previous classes to analyze malaria interventions. Students will work in groups in class to build a simple model in Netlogo (project)</td>
<td>Project Reading 4</td>
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<tr>
<td>11</td>
<td>April 5th</td>
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<td>#</td>
<td>Assignments</td>
<td>Grade</td>
<td>Due Date (all 4PM)</td>
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<td>Reading 1</td>
<td><strong>Read #1 and write a 2-page report.</strong> Submit on Moodle. Briefly describe the Sustainable Development Goals. Do you think these goals are independent of each other? Discuss why or why not. What do you think is the role of systems simulation modeling in public-health decision-making as relevant to the SDGs?</td>
<td>5</td>
<td>Jan 26(^{th}) (Tue)</td>
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<td>Reading 2</td>
<td><strong>Read #9 and #10 and write a report (2 pages):</strong> Summarize the role of modeling in public health decision making; Briefly summary the different types of models (#9); Discuss the relevance of using system dynamics approach to modeling diseases (#10).</td>
<td>5</td>
<td>Feb 2(^{nd}) (Tue)</td>
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<td>Reading 3</td>
<td><strong>Read #2 to #5 and write a report addressing the following (2 pages):</strong> What are the determinants of disease occurrence (include social, behavioral, cultural, and environmental)? What is the definition of health inequity? What are the drivers of health inequity? Discuss the differences and similarities in disease determinants and health inequities in developed and developing countries. What are the challenges faced in disease prevention in developed and developing countries?</td>
<td>5</td>
<td>Feb 9(^{th}) (Tue)</td>
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<tr>
<td>Model 1</td>
<td><strong>Model assignment 1: Simulate transmission of Ebola virus disease (5-8 pages) (reference read #6, #7, and #20)</strong></td>
<td>20</td>
<td>Feb 23(^{rd}) (Tue)</td>
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<td>Model 2</td>
<td><strong>Model assignment 2: Construct model of measles outbreak, conduct economic analysis of intervention (vaccine), and write a report (5-8 pages)</strong></td>
<td>20</td>
<td>March 11(^{th}) (Friday)</td>
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<td>Book Reading</td>
<td><strong>Pick one book from the list in Leisure Reads for reading.</strong> You will write a short essay</td>
<td>10</td>
<td>March 22(^{nd}) (Tue)</td>
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<td>Reading 4</td>
<td><strong>Using the knowledge gained in this class, write a report addressing the broader objectives of the SDGs (2 pages):</strong> Discuss a systems approach to elimination of poverty; Refer to the SDGs, The Global Plan, and all topics you have learned through the duration of this course. What are the challenges to achieving SDGs? What works and what does not (base your opinion on evidence and facts). How can you best use systems modeling for public-health decision making in-line with the SDGs?</td>
<td>5</td>
<td>April 12(^{th})</td>
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<td>Project</td>
<td><strong>Project: presentations (15 mins), report (8-10 pages), policy brief (1 page)</strong></td>
<td>30</td>
<td>April 21(^{st}) and 26(^{th})</td>
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**Reading List and Resources**

Determinants of disease occurrence and barriers to prevention


5. *Infectious diseases in an age of change: The impact of human ecology and behavior on disease transmission*. Washington, DC, USA: National Academies Press; 1995. (week 2) Chapter: Changes in Human Ecology and Behavior in Relation to the Emergence of Diarrheal Diseases, Including Cholera (comparres developing countries to industrialized countries) (week 2)


**Infectious diseases**


**Role of modeling in disease prevention**


HIV and TB


Malaria


Health equity


Health and nutrition of children


Health Systems

Leisure Reads
Zombies haven’t yet made it, but several ‘micro’organisms have shaped our society. The following are just a few books, which provide a broad perspective of the interactions between human development, socio-economics, behavior, environment, and epidemiology. We may be limited in what we can model, but there is a lot that remains unexplored. These books are fun to read, more like detective novels and they are real!

- The American Plague by Molly Caldwell Crosby
- Guns, Germs, and Steel: The Fates of Human Societies
- Infections and Inequalities: The Modern Plagues by Paul Farmer (other books by or about Paul Farmer)
- The Coming Plague: Newly Emerging Diseases in a World Out of Balance by Laurie Garrett
- And The Band Played On

Academic Honesty Policy Statement
Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst.

Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. The procedures outlined below are intended to provide an efficient and orderly process by which action may be taken if it appears that academic dishonesty has occurred and by which students may appeal such actions.

Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

For more information about what constitutes academic dishonesty, please see the Dean of Students’ website:
http://umass.edu/dean_students/codeofconduct/acadhonesty/

Disability Statement
The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with
Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.