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Department of Epidemiology and Biostatistics, College of Public Health - University of Georgia

EPID 8515 – Modeling Infectious Diseases – Fall 2018 – Syllabus

Course Information

Instructor: Andreas Handel
Office Location: 124 B.S. Miller Hall, Health Sciences Campus
Email: ahandel@uga.edu

Office Hours: by appointment

Course Meeting Time and Location

Location: 133 B.S. Miller Hall
UGA buses go to the Health Sciences Campus, see here for route information: https://tps.uga.edu/
Time: Tuesdays 2-4pm (hybrid course, a fair amount of work will be online/outside class)

Textbook and Other Course Material

There is no required textbook. All course materials will be provided. We will use the R software and a number of R packages, including one written by the instructor. All software is freely available for download. The course will be a mix of lecture and hands-on computer exercises. You are expected to bring your laptop with you to class.

Course Description

This course covers the use of mathematical and computational approaches to study infectious diseases. We will discuss models that address both the dynamics of infectious disease spread through populations and the dynamics of pathogens inside an infected individual. You will learn how to build and analyze models for a variety of human and animal diseases. Modeling approaches that will be covered include continuous and discrete time compartmental models, deterministic and stochastic approaches. We will look at the impact of interventions on disease outcomes. We will also discuss tools such as uncertainty and sensitivity analysis. Advanced topics, such as spatial, network and agent-based models, model fitting, and others will be covered based on student interest.

Expect to see a fair share of equations. You will need a decent understanding of basic algebra. You will encounter and learn to understand differential equations. Some previous calculus or differential equation experience is helpful but not required. Previous experience with writing computer programs in general and R in particular is also helpful, but not necessary. If you have no programming experience, expect to spend some extra time getting yourself familiar with R. **As long as you are willing to invest the time to learn the programming and you don't mind thinking quantitatively, you should be able to take the course, independent of your background.**

Formal requirements for the course are either EPID 7010 or ECOL 4000/6000 or permission of instructor. However, knowledge of material from these courses is not really needed. If you didn't take either of these courses, please contact me to get permission to enroll.

Course Learning Objectives

Knowledge: Students will be exposed to the major processes involved in a variety of infectious diseases. They will learn a broad range of basic mathematical and computational methodologies for modeling infectious diseases. They will be able to recognize key parameters in a variety of models and give their meaning. They will be able to derive some basic important results in the theory of infectious disease dynamics.

Comprehension: Students will understand how key processes of within-host and between-host infectious disease dynamics operate. They will be able to articulate the steps required to formulate and analyze mathematical models. They will interpret biological problems as simple mathematical and computational models.

Application: Students will apply ideas and concepts to practical examples through instructional computer lab sessions and as part of the course project. They will be able to write and modify basic models to add more realism or to apply it to a different biological problem.

Analysis: Students will learn to break down large-scale infectious disease observations into component

processes and will understand how important concepts in infectious disease modeling are manifested in real situations. They will be able to correct basic computer programs so that they work as intended. They will be able to distinguish between infectious disease theory and inference from data. They will be able to interpret the results of models in a biological context.

Synthesis: Students will appreciate the progression of ideas that has led to the modern field of infectious disease modeling. They will be able to combine component processes, relevant to infectious diseases, into single models that can explain infectious disease progression in individuals and populations. Students will learn the value of comparative studies by considering several infectious diseases together to ask broader questions about why they affect individuals and populations differently.

Evaluation: Students will learn the usefulness and assumptions of different types of mathematical and computational models in infectious disease studies. They will also be able to critically read and evaluate mathematical modeling studies of infectious diseases that are published in primary research journals. Students will be able to discriminate between good and bad models and will be able to discern what type of data sets can best be used with models to answer research questions.

Course Outline

For an outline of the course, please see the separate course schedule document.

Grading

The grade will be made up as follows:

- 45% Pre- and post-class preparation and accompanying assignments and quizzes.
- 45% A course long research project, broken up into parts and assigned throughout the course. The final results of the project will be one comprehensive, worked example of using infectious disease modeling to address a real-world question. This will involve aspects such as background research, data collection, model building and analysis, and biological interpretation and discussion.
- 10% Class participation

The following grading scale will be used, final grades might be curved: A 93-100, A- 90-93, B+ 87-90, B 83-87, B- 80-83, C+ 77-80, C 73-77, C- 70-73, D 60-70, F <60

Class Attendance, Make-up Policy

You are expected to attend all classes and labs. Missing classes may impact your participation grade. Make-up of assignments is only allowed by prior agreement with the instructor or for special reasons (medical, etc.).

Prerequisites
Getting Help

If you have questions about any aspect of the course, please do not hesitate to ask for help. These are the ways I will be available:

- I usually have time after class to stay around and answer any questions.
- Email me with your questions.
- Email or talk to me to set up an appointment.

University Honor Code and Academic Honesty Policy

All academic work must meet the standards contained in “A Culture of Honesty.” All students are responsible to inform themselves about those standards before performing any academic work. More detailed information about academic honesty can be found at: https://honesty.uga.edu/
Discussions with your classmates and the instructor are encouraged. However, the final work should be your own.

Students with Disabilities

Students with disabilities who require reasonable accommodations in order to participate in course activities or meet course requirements should contact the instructor.

General Disclaimers

This syllabus is a general plan; deviations announced to the class by the instructor may be necessary.