ENV H 543/490: Quantitative Microbial Risk Assessment

Spring Quarter, 2018
Monday, Wednesday, and Friday, 12:30-1:20
HSL Computer Lab C

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OFFICE HOURS: By Appointment

COURSE DESCRIPTION:
This course will cover the processes involved in quantitative assessment of the risk posed from environmentally transmitted pathogens. Students will learn the basic steps of QMRA: hazard identification, exposure assessment, health effects assessment, risk characterization, and risk communication. The course will focus on how to identify and evaluate information from the literature necessary to inform model development; construction of the models in R and Crystal Ball; and interpretation of results from models intended to inform decision making around microbial risk. This course will be of use for public health and health care professionals, microbiologists, civil and environmental engineers, environmental scientists, biosafety professionals, and bio-defense specialists.

COURSE LEARNING OBJECTIVES:
By the end of this course, all students should be able to:

1. List and describe the differences between microbial and chemical risk assessment.
2. Define the purpose and recognize the benefits and limitations of quantitative microbial risk assessment.
3. Identify and define microbial risks.
4. Identify and summarize the major routes of exposure for microbial threats.
5. Recognize and outline the basic frameworks for quantitative microbial risk assessment.
6. Identify microbial hazards and formulate specific problems for which to assess risk.
7. List and distinguish between the various health endpoints for a quantitative microbial risk assessment.
8. Summarize the major host, microbial, and environmental factors affecting exposure assessment.
9. Compare and contrast deterministic and probabilistic approaches to assessment of microbial risk.
10. Summarize the major host, microbial, and environmental factors affecting dose response analysis.

11. Recognize and apply common curve fitting models to dose response data.
12. Define and discuss common metrics for the expression of microbial risk.
13. Analyze and critique published microbial risk assessments.
14. Recognize and define appropriate use of quantitative microbial risk assessment.
15. Identify and explain the factors involved in risk communication.

Additionally, graduate students should be able to:

1. Define and apply deterministic models for the assessment of microbial risk.
2. Apply probabilistic techniques to assess microbial exposures.
3. Integrate exposure and dose/response assessments to arrive at quantitative estimate of individual and population risks.
4. Evaluate sensitivity and uncertainty in microbial risk estimates.

TEXTS AND REFERENCES:

The recommended text for this course is *Quantitative Microbial Risk Assessment* 2nd ed. (Haas, Rose, and Gerba; John Wiley & Sons, Inc.). The book is available through the UW library ebook collection. Code from the book is posted at Github.

Other useful texts are and EnvStats: An R Package for Environmental Statistics (Millard; Springer New York) and *Microbiological Risk Assessment in Food Processing* (Brown and Stringer; Woodhead Publishing). Both books are available through the UW library ebook collection. Any additional readings and course materials will be available through the course webpage or handed out in class.

The following sources are recommended supportive references for course topics:

Web-
QMRAwiki
USDA/EPA Microbial Risk Assessment Guideline
Codex Alimentarius
IISI Tools for Microbiological Risk Assessment
EPA Microbiological Risk Assessment (MRA) Tools, Methods, and Approaches for Water Media
Foodrisk.org

Books-
Manual of Environmental Microbiology, 2nd edition, ASM Press
Disinfection, Sterilization and Preservation, 5th edition, LWW
Metcalf and Eddy's Wastewater Engineering: Treatment and Reuse, McGraw-Hill
Water Quality and Treatment, 5th edition, AWWA
Bioaerosols Handbook, Lewis
Food Microbiology, Doyle
Any Basic Microbiology Text (e.g. Madigan, Martinko and Parker; Prescott, Harley and Klein; etc.)

Journals-
Risk Analysis
Journal of Exposure Science and Environmental Epidemiology
Microbial Risk Analysis
Journal of Applied Microbiology
Letters in Applied Microbiology
Journal of Applied and Environmental Microbiology
Journal of Water and Health
Journal of Food Protection
International Journal of Food Microbiology
Emerging Infectious Disease

CLASS PARTICIPATION: Although class attendance is not expressly required, the majority of the course involves around in-class learning activities and group work. Students will not have the opportunity to earn class participation credit for course periods during which they are absent.

COURSE FORMAT: Classes will include a mix of lecture-based format and hands on computer-based training. Additionally, several required QMRA content lectures will be posted as Panopto recordings.

GRADING OPPORTUNITIES:

For the sake of this class, letter and numerical grades will typically be distributed according to the university grading scale between the following standards:

A (4.0)= Excellent and exceptional work (typically >90% of available points) D (1.0) = Deficient work (typically <66% of available points)

It is expected that most students will perform at a level of ~3.5.

Graduate Students:

Points will be available according to the following percentage breakdown:

Homework (20%): Students will have the opportunity to complete 4 homework assignments, each worth 5 % of the overall grade. Homework assignments will be designed around each of the major steps in a QMRA (hazard identification, exposure assessment, health effects assessment, and risk characterization) and are meant to guide the student towards successful completion of the oral presentation and final written risk assessment. It is expected that assignments will be turned in through the course canvas page.

Quizzes (30%): 5 quizzes, focusing on the Panopto lectures and readings, will be given. Each will consist primarily of 3-5 questions (consisting typically of short answer questions, but may include multiple choice, and fill-in the blank questions as well). Quizzes will be made on Mondays and must be completed by Friday of the same week at 5:00pm.

Class Participation (5%): Students may earn participation credit by contributing to classroom discussion and participation in modeling exercises. Additionally, participation-credit questions may be asked in class for email response. Students will also be expected to participate equitably in their risk assessment groups. Peer evaluation will be a factor in group participation.

Oral Presentation of Risk Assessment (20%): Students will give in-class presentations of risk assessments on their chosen topics during the last two weeks of class.

Final Risk Assessment (25%): Final written risk assessments will be due by 5:00 on the last class day of the quarter. Final written risk assessments must be submitted through canvas (one file for model and one file for written report).

Undergraduate Students:

Points will be available according to the following percentage breakdown:

Homework (20%): Students will have the opportunity to complete 4 homework assignments, each worth 5 % of the overall grade. Homework assignments will be designed around specific exercises following the QMRA framework. It is expected that assignments will be turned in through the course canvas page.

Quizzes (30%): 5 quizzes, focusing on the Panopto lectures and readings, will be given. Each will

consist primarily of 3-5 questions (consisting typically of short answer questions, but may include multiple choice, and fill-in the blank questions as well). Quizzes will be made on Mondays and must be completed by Friday of the same week at 5:00pm.

Class Participation (5%): Students may earn participation credit by contributing to classroom discussion and participation in modeling exercises. Additionally, participation-credit questions may be asked in class for email response. Students will also be expected to participate equitably in their risk assessment groups. Peer evaluation will be a factor in group participation.

Midterm Exam (20%): Students will be given a take-home midterm exam. Exam format will be short answer, multiple choice, matching, and true-false/explain.

Final Exam (25%): Students will be given a final exam focused on the graduate student case studies. Exam will be a take home exam and will be due on the last day of finals week. Format will largely be short answer.

ACADEMIC INTEGRITY
(http://sph.washington.edu/students/academicintegrity/)
Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity. The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and the SPH Academic Integrity Policy. Any suspected cases of academic misconduct will be handled according to University of

Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

ACCESS AND ACCOMMODATION
(http://depts.washington.edu/uwdrs/faculty-resources/syllabus-statement/):
Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

READINGS
Readings will commonly be chapters from the recommended text or other reference texts, but may include website or journal articles.

COURSE RULES
1. Come to class, please try to let me know ahead of time if you cannot make it.
2. Arrive on time
3. Turn in assignments on time
4. Come to class prepared (keep up with reading and assignments)
5. Be courteous (No newspapers, audible cell phones, PDAs, beepers)

6. Refrain from unnecessary talking
7. ASK QUESTIONS
8. Try to remain awake (at least no snoring please)
9. Let me know how we are doing (if I am moving too fast, not being clear, or otherwise not getting the message across, I need to know.)

COURSE CONTENT OUTLINE:

Date			Class	Panopto	Location	Instructor
		Introduction/Why is Microbial Risk Assessment Different than Chemical Risk Assessment				
26-Mar	M				HSL Lab C	Meschke
				Overview of Microbial Risk		
28-Mar	W	Introduction to Excel and Crystal Ball		Assessment Frameworks	HSL Lab C	Kissel
		Introduction to Excel and Crystal Ball				
30-Mar	F	(cont'd.)			HSL Lab C	Kissel
2-Apr	M	Introduction to R			HSL Lab C	High
4-Apr	W	Introduction to R		Identification of Microbial	HSL Lab C	High
6-Apr	F	Introduction to R		Risks/Exposure Routes	HSL Lab C	High
9-Apr	M	Hazard ID/Problem Formulation		Problem Formulation/Determination of Health Endpoint	**HSB E-216**	Meschke
11-Apr	W	2D Monte Carlo in Crystal		Exposure Assessment	HSL Lab C	Kissel
13-Apr	F	Exposure Assessment EX. **Group Work**			HSL Lab C	Meschke/Kissel
16-Apr	M	Dose Response Modeling (Excel)		Dose Response Assessment	HSL Lab C	Kissel
18-Apr	W	Dose Response Modeling (R)			HSL Lab C	Meschke
20-Apr	F	**Group Work**			HSL Lab C	Meschke/Kissel
23-Apr	M	Risk Characterization			HSL Lab C	Kissel
25-Apr	W	Risk Characterization/Communication			HSL Lab C	Meschke
27-Apr	F	**Group Work**			HSL Lab C	Meschke/Kissel
30-Apr	M	**Group Work**			HSL Lab C	Meschke/Kissel
2-May	W	QMRA cases: Prediction vs observation			HSL Lab C	Schoen
4-May	F	**Group Work**			HSL Lab C	Meschke/Kissel
7-May	M	Bayesian approaches to QMRA			HSL Lab C	Schoen
9-May	W	Transmission Models			HSL Lab C	Meschke
11-May	F	Transmission Models			HSL Lab C	Meschke
14-May	M	**Group Work**			HSL Lab C	Meschke/Kissel
16-May	W	**Group Work**			HSL Lab C	Meschke/Kissel
18-May	F	**Group Work**			HSL Lab C	Meschke/Kissel
21-May	M	Group Presentation			HSL Lab C	Meschke/Kissel
23-May	W	Group Presentation			HSL Lab C	Meschke/Kissel
25-May	F	Group Presentation			HSL Lab C	Meschke/Kissel
28-May	M	**MEMORIAL DAY**			**NO CLASS**	
1-Jun	W	Group Presentation			HSL Lab C	Meschke/Kissel
		Final Risk Assessments and Group				
8-Jun	F	**Evaluations/Undergraduate Final Exams Due by 4:20**			HSL Lab C	Meschke/Kissel