ENV H 543/490: Quantitative Microbial Risk Assessment

Spring Quarter, 2021
Monday & Wednesday, 3:30-4:50
Online and by apt.

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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 Excel; 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.
14. Recognize and define appropriate use of quantitative microbial risk assessment.
15. Identify and explain the factors involved in risk communication.
16. Define and apply deterministic models for the assessment of microbial risk.
17. Apply probabilistic techniques to assess microbial exposures.
18. Integrate exposure and dose/response assessments to arrive at quantitative estimate of individual and population risks.
19. Evaluate sensitivity and uncertainty in microbial risk estimates.

TEXTS AND REFERENCES:
The required 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-**
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
Indoor Air
COURSE FORMAT: Most course material will be presented through a mix of recorded lectures and assigned readings. Course time will be reserved for working through examples and comment on group project work. Students will be expected to view several required QMRA content lectures as Panopto recordings outside of class. Additionally the course will closely follow required readings in the textbook. Comprehension of readings and Panopto lectures will be assessed with on line quizzes.

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 (40%): Students will have the opportunity to complete 7 homework assignments. Homework assignments will be designed around major steps in a QMRA and are meant to guide the student towards successful completion of the final risk assessment. It is expected that assignments will be turned in through the course canvas page.

- Quizzes (30%): 9 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).

- Final Risk Assessment (30%): Final written risk assessments will be due by 5:00 on the last Day of Finals. Final written risk assessments must be submitted through canvas (one file for model and one file for written report).

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.

RELIGIOUS ACCOMMODATIONS
Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW’s policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form.

READINGS
Required readings are chapters from the required texts.
<table>
<thead>
<tr>
<th>Date</th>
<th>Class Topic</th>
<th>Panopto</th>
<th>Reading</th>
<th>Online Quizzes</th>
<th>Homework</th>
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<tbody>
<tr>
<td>29-Mar</td>
<td>Introduction/Why is Microbial Risk Assessment Different than Chemical Risk Assessment</td>
<td>Overview of Microbial Risk Assessment Frameworks</td>
<td>Chapter 1 Motivation and Chapter 2 Microbial Agents and Transmission</td>
<td>Online Quizzes</td>
<td>_homework</td>
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<td>Identification of Microbial Risks/Exposure Routes</td>
<td>Chapter 3 Risk Assessment Paradigms</td>
<td>Chapter 4 Conducting the Hazard Identification</td>
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<td>31-Mar</td>
<td>Introduction to Excel R</td>
<td>Problem Formulation/Determination of Health Endpoint</td>
<td>Chapter 5 Analytical Methods and the QMRA Framework: Developing Occurrence and Exposure Databases</td>
<td>Problem Formulation/Hazard ID</td>
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<td>2-Apr</td>
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<td>Chapter 5 and 4 Quiz</td>
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<td>5-Apr</td>
<td>Data Sources and Distribution Selection</td>
<td>Introduction to R 1-3</td>
<td>Chapter 6 Exposure Assessment</td>
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<td>7-Apr</td>
<td>W</td>
<td>Exposure Assessment</td>
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<td>Chapter 5 and 6 Quizzes</td>
<td>Exposure Assessment Narrative and Schematic</td>
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<td>9-Apr</td>
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<td>12-Apr</td>
<td>Exposure assessment in R</td>
<td>Dose Response Assessment</td>
<td>Chapter 7 Predictive Microbiology</td>
<td>Chapter 7 and 8 Quizzes</td>
<td>Exposure Assessment Model Code</td>
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<td>14-Apr</td>
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<td>Chapter 8 Conducting The Dose Response Assessment</td>
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<td>19-Apr</td>
<td>Dose Response Modeling (Excel)</td>
<td>Risk Metrics: DALYs, QALYs, etc.</td>
<td>Chapter 9 Uncertainty</td>
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<td>28-Apr</td>
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<td>Chapter 10 Population Disease Transmission</td>
<td>Chapter 9 and 10 Quizzes</td>
<td>Dose Response Narrative</td>
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<td>3-May</td>
<td>M</td>
<td>Perception of Risk/Risk Communication/Risk Management</td>
<td>Chapter 11 Risk Characterization and Decision Making</td>
<td>Chapter 9 and 10 Quizzes</td>
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<td>5-May</td>
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<td>Chapter 11 and Risk Communication Quizzes</td>
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<td>10-May</td>
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<td>Risk Characterization</td>
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<td>Sensitivity and Uncertainty</td>
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<td>12-May</td>
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<td>Analysis</td>
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<td>14-May</td>
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<td>Risk Characterization</td>
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<td>17-May</td>
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<td>Trouble Shooting</td>
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<td>21-May</td>
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<td>Risk Characterization</td>
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<td>11-Jun</td>
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<td>FINAL RISK ASSESSMENTS DUE</td>
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