

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.
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.
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-

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

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.

COURSE CONTENT OUTLINE:

Date	Class Topic	Panopto	Reading	Online Quizzes	Homework
29-Mar	M	Introduction/Why is Microbial Risk Assessment Different than Chemical Risk Assessment	Overview of Microbial Risk Assessment Frameworks	Chapter 1 Motivation and Chapter 2 Microbial Agents and Transmission	
31-Mar	W	Introduction to Excel R	Identification of Microbial Risks/Exposure Routes	Chapter 3 Risk Assessment Paradigms	
			Problem Formulation/Determination of Health Endpoint	Chapter 4 Conducting the Hazard Identification	
2-Apr	F			Chapter 3 and 4 Quiz	Problem Formulation/Hazard ID
5-Apr	M	Data Sources and Distribution Selection	Introduction to R 1-3	Chapter 5 Analytical Methods and theQMRA Framework: Developing Occurrence and Exposure Databases	
7-Apr	W		Exposure Assessment	Chapter 6 Exposure Assessment	
9-Apr	F			Chapter 5 and 6 Quizzes	Exposure Assessment Narrative and Schematic
12-Apr	M	Exposure assessment in R	Dose Response Assessment	Chapter 7 Predictive Microbiology	
14-Apr	W			Chapter 8 Conducting The Dose Response Assessment	
16-Apr	F			Chapter 7 and 8 Quizzes	Exposure Assessment Model Code
19-Apr	M	Dose Response Modeling (Excel)	Risk Metrics: DALYs, QALYs, etc.	Chapter 9 Uncertainty	
28-Apr	W			Chapter 10 Population Disease Transmission	
30-Apr	F			Chapter 9 and 10 Quizzes	Dose Response Narrative
3-May	M	Dose Response Modeling (R)	Perception of Risk/Risk Communication/Risk Management	Chapter 11 Risk Characterization and Decision Making	
5-May	W				

Chapter 11 and Risk
Communication

Quizzes

Dose Response Model

7-May F

10-May M Risk Characterization
Sensitivity and Uncertainty

12-May W Analysis

14-May F

Risk Characterization
(Deterministic Estimate)

17-May M Trouble Shooting

19-May W Trouble Shooting

21-May F

Risk Characterization
(Probabilistic Output)

24-May M Trouble Shooting

26-May W Trouble Shooting

31-May M Trouble Shooting

2-Jun W Trouble Shooting

11-Jun W

FINAL RISK
ASSESSMENTS DUE