

# ENV H 543: Quantitative Microbial Risk Assessment

Spring Quarter, 2016  
Monday, Wednesday, and Friday, 12:30-1:20  
HSL Computer Lab C (exceptions: 4/8 And 4/11 in LTL)

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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, students will 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. Define and apply deterministic models for the assessment of microbial risk.
10. Compare and contrast deterministic and probabilistic approaches to assessment of microbial risk.
11. Apply probabilistic techniques to assess microbial exposures.
12. Summarize the major host, microbial, and environmental factors affecting dose response analysis.

13. Recognize and apply common curve fitting models to dose response data.
14. Integrate exposure and dose/response assessments to arrive at quantitative estimate of individual and population risks.
15. Define and discuss common metrics for the expression of microbial risk.
16. Evaluate sensitivity and uncertainty in microbial risk estimates.
17. Analyze and critique published microbial risk assessments
18. Recognize and define appropriate use of quantitative microbial risk assessment.
19. Identify and explain the factors involved in risk communication.

#### TEXTS AND REFERENCES:

The recommended text for this course is *Quantitative Microbial Risk Assessment* 2<sup>nd</sup> 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, 2<sup>nd</sup> edition, ASM Press

Disinfection, Sterilization and Preservation, 5<sup>th</sup> edition, LWW

Metcalf and Eddy's Wastewater Engineering: Treatment and Reuse, McGraw-Hill

Water Quality and Treatment, 5<sup>th</sup> 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

**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.

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).

**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](mailto:uwdrs@uw.edu) or [disability.uw.edu](http://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
28-Mar	M	Introduction/Why is Microbial Risk Assessment Different than Chemical Risk Assessment		HSL Lab C	Meschke
30-Mar	W	Introduction to Excel and Crystal Ball	Overview of Microbial Risk Assessment Frameworks	HSL Lab C	Kissel
1-Apr	F	Introduction to Excel and Crystal Ball (cont'd.)	Identification of Microbial Risks/Exposure Routes	HSL Lab C	Kissel
4-Apr	M	Introduction to R	Problem Formulation/Determination of Health Endpoint	HSL Lab C	Reiss
6-Apr	W	Exposure assessment in R	Exposure Assessment	HSL Lab C	Reiss
8-Apr	F	Exposure assessment in R		<b>LTL</b>	Reiss?
11-Apr	M	Dose Response Modeling (Excel)	Dose Response Assessment	<b>LTL</b>	Kissel
13-Apr	W	Dose Response Modeling (R)		HSL Lab C	Meschke
15-Apr	F	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
18-Apr	M	Distribution Selection and Uncertainty Analysis		HSL Lab C	Meschke/Kissel
20-Apr	W	Distribution Selection and Uncertainty Analysis		HSL Lab C	Meschke/Kissel
22-Apr	F	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
25-Apr	M	Risk Characterization	Risk Metrics: DALYs, QALYs, etc.	HSL Lab C	Meschke/Kissel
27-Apr	W	Risk Characterization	Perception of Risk/Risk Communication/Risk Management	HSL Lab C	Meschke/Kissel
29-Apr	F	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
2-May	M	Application of QMRA at EPA		HSL Lab C	Schoen
4-May	W	QMRA cases: Prediction vs observation		HSL Lab C	Schoen
6-May	F	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
9-May	M	Bayesian approaches to QMRA		HSL Lab C	Schoen
11-May	W	Transmission Models		HSL Lab C	Meschke
13-May	F	Transmission Models		HSL Lab C	Meschke
16-May	M	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
18-May	W	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
20-May	F	<b>Group Work</b>		HSL Lab C	Meschke/Kissel
23-May	M	Group Presentation		HSL Lab C	Meschke/Kissel
25-May	W	Group Presentation		HSL Lab C	Meschke/Kissel
27-May	F	Group Presentation		HSL Lab C	Meschke/Kissel
30-May	M	<b>MEMORIAL DAY</b>		<b>NO CLASS</b>	
1-Jun	W	Group Presentation		HSL Lab C	Meschke/Kissel
3-Jun	F	<b>Final Risk Assessments and Group Evaluations Due by 4:20</b>		HSL Lab C	Meschke/Kissel