Quantitative microbial risk assessment of pathogens in food and environmental systems

ANS 6637, Sec. 6637, class #1941, 3 credit hours

Class Periods: Tuesdays and Thursdays, 8.30 am – 10.25 am
Location: Animal Science Building, 2250 Shealy Drive, Gainesville, Florida 32611; room 201
Academic Term: Spring 2025

Instructor:
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Course Description
Principles of microbial risk assessment modeling in food chains and the environment. Parameter estimation, model implementation and stochastic simulation in the statistical software **R**.
Foods, water, air and fomites can be contaminated by infectious disease agents (e.g., micro-organisms, viruses, protozoa). These may be introduced at different locations, originate from different reservoirs and the population sizes and properties of these agents may change throughout transmission chains. These agents can infect humans when contaminated foods or water are consumed or when there is contact with contaminated objects. In quantitative microbial risk assessment (QMRA), knowledge about the prevalence and concentration of an infectious agent in different steps of a transmission chain are combined with quantification of human behavior and dose-response relations to calculate the risk for humans to become infected and ill. The fundamentals of QMRA modeling will be taught through a combination of lectures, case studies and coding practicals.

Course Pre-Requisites / Co-Requisites
ALS 5932, STA 6166 or similar statistics course; knowledge of the **R** programming environment.

Course Objectives
At the end of this course, students will be acquainted with the principles of microbial risk assessment modeling, related to infectious foodborne diseases. In addition, after completing this course student will be able to:

- Explain the different elements of the risk analysis paradigm;
- Recognize the four steps of microbial risk assessment: hazard identification, hazard characterization, exposure assessment and risk characterization;
- Organize experimental data for statistical analysis;
- Critically evaluate published QMRA studies and use the results for decision making purposes;

- Define and obtain the data necessary for constructing risk assessment models;
- Discriminate the concepts of variability and uncertainty;
- Represent microbial data by appropriate probability distributions;
- Implement different models for microbial growth and inactivation;
- Construct (modules of) microbial risk assessment models in the statistical software **R**;
- Use the models for determining the efficiency of intervention strategies;
- Understand the challenges and opportunities to apply QMRA modeling in low- and middle-income countries.

Materials and Supply Fees

Students are expected to bring their own laptop. A recent version of the **R** software (http://www.r-project.org) and **RStudio** (https://posit.co/download/rstudio-desktop/) should be installed.

Recommended Materials

- Wickham H, Grolemund G. R for data science. https://r4ds.hadley.nz
- The Epidemiologist R Handbook. https://epirhandbook.com
- Further materials will be provided during the course.

Course Schedule

Date	Topic	Quizzes and exams
January 14, 2025	Course introduction General principles of risk analysis	
January 16, 2025	General principles of risk assessment	Quiz 1
January 21, 2025	Primer in statistics and R #1	
January 23, 2025	Primer in statistics and R #2	Quiz 2
January 28, 2025	Group discussion of QMRA studies Introduction to case studies	QMRA case study (Powerpoint: March 26 @ 11:59PM) (Presentation: March 27 & April 1in class)
January 30, 2025	Primer in statistics and R #3	
February 4, 2025	Primer in statistics and R #4	Quiz 3
February 6, 2025	Data management in the microbiological laboratory #1	
February 11 2025	Data management in the microbiological laboratory #2	Quiz 4
February 13, 2025	Statistics of microbial counts #1	
February 18, 2025	Statistics of microbial counts #2	
February 20, 2025	Statistics of microbial counts #3	Practice exam
February 25, 2025	Fitting distributions to data #1	
February 27, 2025	Fitting distributions to data #2	Exam 1. Simulation and fitting
March 4, 2025	Growth and inactivation modeling #1	
March 6, 2025	Growth and inactivation modeling #2	Quiz 5
March 11, 2025	Farm-to-fork modeling #1	
March 13, 2025	Farm-to-fork modeling #2	
	SPRING BREAK	
March 25, 2025	Farm-to-fork modeling #3	Quiz 6
March 27, 2025	Case study presentations	
April 1, 2025	Case study presentations	
April 3, 2025	Dose-response modeling #1	
April 8, 2025	Dose-response modeling #2	Quiz 7
April 10, 2025	Risk characterization #1	
April 15, 2025	Risk characterization #2	Exam 2. QMRA model
April 17, 2025	Risk ranking	
April 22, 2025	QMRA in low-and middle-income countries	

Attendance Policy, Class Expectations, and Make-Up Policy

UF students are expected to attend class in person, attendance will be monitored with attendance sheets. Contact the instructor before class hours in case of emergencies prohibiting class attendance.

The course is also open to external student from other (inter)national universities who will be provided access via Zoom. To receive class credits, external students need to enroll in a special topic at their own institution under the responsibility of their primary adviser. Attendance will be monitored by the course organizer.

Students will be expected to work in groups of two or three during in-class practicals.

Cell phones should be silenced in class. Reading of newspapers, working on assignments for other classes, or other activities that are not part of the class are not allowed during class time. Missed exams will be dealt with on an individual basis. Excused absences must be consistent with university policies in the Graduate Catalog (https://gradcatalog.ufl.edu/graduate/) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Evaluation of Grades
During the course, eight self-administered quizzes will be provided. Answer sheets will be shared on week later and are intended for self-evaluation. Questions can be discussed with the instructors during office hours. Grades will be based on attendance, two exams and a case-study presentation.

Assignment	***Total Points***	***Percentage of Final Grade***
Attendance	27	10%
Exam 1	100	35%
Exam 2	100	35%
Case study presentation	100	20%
Total		100%

Grading Policy

Percent	***Grade***	***Grade Points***
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: UF Graduate Catalog

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at: https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this

assignment." The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Use of generative artificial intelligence

The main goal of this course is to support your understanding and ability to correctly implement the principles of microbial risk assessment, using the statistical language R as a tool. R coding is challenging, certainly in the beginning. The use of generative artificial intelligence (GAI) tools can be helpful in creating or checking effective code. In principle you may submit AI-generated code, or code that is based on or derived from AI-generated code, if this use is properly documented: you need to include the prompt and the significant parts of the response. AI tools may help you avoid syntax errors, but there is no guarantee that the generated code is correct., and it is each student's responsibility to assess the validity and applicability of any GAI output that is submitted - you bear the final responsibility. Violations of this policy will be considered academic misconduct. Classroom exercises are intended, among others, to improve your understanding of the R language and use of GAI tools in the classroom is not allowed.

Software Use

All faculty, staff, and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Student Privacy

Class Recordings

Our class sessions may be audio and visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Grades

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the Notification to Students of FERPA Rights.

Services for Students with Disabilities

The Disability Resource Center coordinates services for students with disabilities including special accommodations. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation
0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/.

Diversity, Equity and Inclusion Statement

The Department of Animal Sciences believes an inclusive, equity-minded environment includes access to higher- and continued education. We develop flexible, efficient, and accessible learning environments that welcome and support diversity. Diversity can include disability, age, socioeconomic status, ethnicity, race, nationality, religion, gender identity, sexuality, and culture. We expect all our community members (students, staff, and faculty) to act respectfully towards others (online and in person) and to utilize differences of opinion as learning opportunities. We also want you to feel comfortable asking for reasonable accommodations so that all students can participate in this course equitably.

Campus Helping Resources
Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

Health and Wellness

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.

University Police Department: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

GatorWell Health Promotion Services: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the GatorWell website or call 352-273-4450.

Academic Resources

E-learning technical support:
Contact the **UF Computing Help Desk** at 352-392-4357 or via e-mail at helpdesk@ufl.edu.

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

On-Line Students Complaints