

Quantitative microbial risk assessment of pathogens in food systems

ANS 6932 / FOS 6936

February 29-March 4, 2016 (statistics and R primer on February 26, 2016)

1. Course Description– Modeling principles of microbial risk assessment in food chains. Model implementation in stochastic simulation software (R). Focus on the bottom-up food chain approach and basic principles of top-down approach.
2. 3 credits.
3. Pre-requisites and Co-requisites – ALS 5932, STA 6166 or similar statistics course; knowledge of the R programming environment.
4. Course location: L.E. 'Red' Larson Dairy Science Building, 2250 Shealy Drive, Gainesville, Florida 3261; room 201
5. Instructor – Arie H. Havelaar
 - Office location: 2055 Mowry Road
 - Telephone: (352) 273- 5921(office)
 - E-mail address: ariehavelaar@ufl.edu
 - Class Web site: login to e-Learning at <https://lss.at.ufl.edu/>
 - Office hours: By appointment

Co-instructor – Brecht Devleesschauwer

 - Office location: 2250 Shealy Drive
 - Telephone: (352) 392-1981 Ext. 230 (office)
 - E-mail address: bdevleesschauwer@ufl.edu
 - Office hours: By appointment

Co-instructor (visiting scientist) – Joost H. Smid

 - Office location: Utrecht University
 - E-mail address: j.h.smid@uu.nl
 - Office hours: By appointment
6. General scope - Foods can be contaminated by infectious agents (e.g. micro-organisms, viruses, antimicrobial resistance genes). These may be introduced in food chains at different locations and the population sizes and properties of these agents may change throughout transmission chains. These agents can infect humans when contaminated foods are consumed. A bottom-up approach, in which knowledge about the prevalence and numbers of an infectious agent in a food source is combined with knowledge about the transmission routes from that source to humans and dose-response relations, can be used to calculate the risk for humans to become infected. Alternatively, observational epidemiological information may be used to assess risk factors in a top-down approach, typically making use of statistical regression models. Also, models exist using elements from both approaches, e.g. for source attribution. These approaches have different starting points, use different types of data and serve different purposes. In this course, we

focus on the bottom-up approach yet highlight the differences between both. The fundamentals of risk assessment will be taught through a combination of lectures, case studies and computer practicals.

7. Course Objectives

At the end of this course, students will be acquainted with the principles of microbial risk assessment modeling, observational epidemiology, and source attribution, related to infectious foodborne diseases. In addition, after completing this course students 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.
- define and obtain the data necessary for constructing risk assessment models;
- discriminate the concepts of variability and uncertainty;
- represent data by appropriate probability distributions
- construct microbial risk assessment models in the statistical software R
- use the models for determining the efficiency of intervention strategies;
- explain the results of a risk assessment study to a risk manager
- contrast the bottom-up and top-down approaches used in risk assessment of infectious agents
- explain the principles of burden of disease assessment and attribution

8. Meeting Times – February 26, 2016 (9 AM – 12 noon and 1 PM- 5 PM)
(Compulsory primer in statistics and R),
February 29 – March 4, 2016 (9 AM – 5 PM) (main course)

9. Meeting Location – Room 201, Building 499

11. Material and Supply Fees – No fee.

12. Textbooks and Software Required

Students are expected to bring their own laptop computer with a recent version of the R software (<http://www.r-project.org>) and RStudio (<http://www.rstudio.com/products/RStudio/>) installed.

Recommended Reading

For statistics and R primer:

- Knell RJ. Introductory R.

<http://www.introductoryr.co.uk/Introductory%20R%20example%20chapters.pdf>.

- Maindonald J. Using R for Data Analysis and Graphics - Introduction, Examples and Commentary” (<http://cran.r-project.org/doc/contrib/usingR.pdf>)

For main course:

- U.S. Department of Agriculture/Food Safety and Inspection Service (USDA/FSIS) and U.S. Environmental Protection Agency (EPA) (2012). Microbial Risk Assessment Guideline: Pathogenic Organisms with Focus on Food and Water. FSIS Publication No.USDA/FSIS/2012-001; EPA Publication No. EPA/100/J12/001.

- Nauta MJ. 2008. The Modular Process Risk Model (MPRM): a Structured Approach to Food Chain Exposure Assessment, p 99-136. In Schaffner D, Doyle M (ed), Microbial Risk Analysis of Foods. ASM Press, Washington, DC.
- Teunis PFM, Havelaar AH. The Beta-Poisson dose-response model is not a single-hit model. Risk Anal. 2000;20:513-520.
- Mughini Gras L, Smid JH, Wagenaar JA, de Boer AG, Havelaar AH, Friesema IH, et al. Risk factors for campylobacteriosis of chicken, ruminant, and environmental origin: a combined case-control and source attribution analysis. PloS One. 2012;7:e42599
- Gallagher D, Ebel ED, Gallagher O, Labarre D, Williams MS, Golden NJ, et al. Characterizing uncertainty when evaluating risk management metrics: risk assessment modeling of *Listeria monocytogenes* contamination in ready-to-eat deli meats. Int J Food Microbiol. 2013;162:266-275.
- Bouwknegt M, Verhaelen K, Rzezutka A, Kozyra I, Maunula L, von Bonsdorff CH, et al. Quantitative farm-to-fork risk assessment model for norovirus and hepatitis A virus in European leafy green vegetable and berry fruit supply chains. Int J Food Microbiol. 2015;198:50-58.

Introductory materials for case studies will be provided during the course.

11. Attendance and Expectations - Requirements for class attendance, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>. All students are expected to attend class. 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.
12. Grading – Grades will be based on assignments (30 points), development of a risk model (30 points), case study presentation (20 points), attendance (10 points), and peer evaluation (10 points – based on participation and contribution to group work). See course schedule for details.
Grading Scale - The grading scale is shown below and it is in agreement with UF grading policies. 1 point corresponds to 1%.

A	95.0-100%
A-	90.0 – 94.9%
B+	85.0 – 89.9%
B	80.0 - 84.9%
B-	75.0 - 79.9%
C+	70.0 - 74.9%
C	65.0 – 69.9%
C-	60.0 – 64.9%
D+	55.0-59.9%
D	50.0-54.9%
D-	45.0-49.9%
E	< 45.0%

For more information on UF grades and grading policies, please visit: <http://gradcatalog.ufl.edu/content.php?catoid=2&navoid=762#grades>

13. Class policies – Students will be expected to work on their own during the practicals although discussions on how to approach problems are encouraged. Case studies will be assigned to teams of 3 – 4 students, who collaboratively build a risk model and prepare a presentation about the model and its implications for food safety management.
14. Online course evaluation process – 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. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.
15. Honesty Policy – As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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.”*
It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.
16. Accommodation for Students with Disabilities – The Disability Resource Center coordinates the needed accommodations of students with disabilities. 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, www.dso.ufl.edu/drc/ .
17. 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.

18. Campus helping resources - Students experiencing crises or personal problems that interfere with their general well-being 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.

*University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,
www.counseling.ufl.edu/cwc/*

- Counseling Services
- Groups and Workshops
- Outreach and Consultation
- Self-Help Library
- Wellness Coaching

Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

For emergencies, contact the University Police Department: 392-1111 or 9-1-1.

Course outline

Date	Topic	Assignments and due dates*
February 26	Primer in statistics and R	#1. Statistical distributions; March 11
February 29 AM	General concepts of risk analysis	
	Hazard identification	
	Exposure assessment	
PM	Case study	
March 1 AM	Exposure assessment (continued)	
	Practical MPRM STEC O157 in beef	#2. Exposure modeling; March 13
PM	Case study	
March 2 AM	Food consumption data	
	Dose-response modeling	
	Practical dose-response modeling	#3. Dose response modeling; March 17
PM	Case study	
March 3 AM	Risk characterization	
	Tools for QMRA	
PM	Case study	
March 4 AM	Top down approaches for MRA	
	Burden of disease	
	Attribution	
PM	Practical attribution modeling	
	Presentations case studies	#4. Presentation; March 4 #5. Risk assessment model; March 8

* Assignments are ordered by date of the related topic, not by due date