

**Applied Concepts of Bayesian Risk Assessment
In Animal Health and Food Safety
Date: September 8th – 21st, 2021
Dr. Javier Sanchez**

This course will introduce the concepts of probabilistic risk analysis (PRA) using a Monte Carlo and Bayesian frameworks. PRA is an analysis of the frequency and consequences of unwanted events in a system. This type of analysis relies on probabilistic (i.e., predictive) models and associated data. Participants will compare Monte Carlo with Bayesian based methods applied to risk assessment. Bayesian inference techniques are useful in situations where empirical evidence is not available because, unlike frequentist statistical methods, the Bayesian paradigm incorporates this type of information. Furthermore, from a practical perspective, Bayesian techniques, which represent uncertainty with probability distributions, provide a ready framework for the propagation of uncertainties through the risk models.

At the end of the workshop the participants should:

- Be familiar with Monte Carlo and Bayesian risk assessment frameworks
- Conduct basic Monte Carlo simulations
- Understand components of a Bayesian risk assessment model
- Develop posterior distributions from common Bayesian models in Excel and OpenBUGS
- Apply these concepts to their own risk models.

Main course text:

1. Bayesian Inference for Probabilistic Risk Assessment. 2011. A practitioner's guidebook. D. Kelly and C. Smith. Springer

Supplementary reference reading material:

Risk Assessment

2. Quantitative Microbial Risk Assessment. 2014. Second Edition. Haas CN et al. Wiley
3. Risk Analysis: A quantitative guide. 2008. Third Edition. Vose.D. Wiley.

Bayesian

4. Applied Bayesian Statistics with R and OpenBUGS examples. 2013. MK Cowles. Springer.
5. The BUGS book. A practical introduction to Bayesian Analysis. 2013. D. Lunn et al. CRC Press.
6. Veterinary Epidemiological Research. 2009. Chapter 24. Dohoo et al. VER Inc.

Previous knowledge:

- Participants should be familiar with the concepts of risk, probability, probability distributions, and they should have a basic knowledge of R.

Software required:

- Participants should have installed in their laptops R and OpenBUGS (<http://www.openbugs.net/>) installed.

This course will be offered on-line (pre-recorded sessions and live) and if sufficient interest exists for an in-person component of the course at UPEI, it will be arranged before the course starts. The course will include 10 sessions of approximately 3 hrs each. A preliminary program is presented below. Final details will be posted before the course.

Tentative Program

Sessions 1 - 2	Lecture	Lab
Stream (live) and video	Introduction to Risk Analysis. OIE and FAO frameworks. Monte Carlo (MC) and Bayesian approaches for risk assessment. Developing a model. Review random processes and probability distributions	Discussion Examples in Food Safety: MC and Bayesian Project discussion
Sessions 3 - 4	Lecture	Lab
Stream (live) and video	Common Probabilistic Models in Probabilistic Risk Assessment Dose – Response models	Project discussion – Model development Introduction to R – mc2d <u>Exercise</u> : Binomial and Poisson models <u>Exercise</u> : Binomial and Poisson models
Sessions 5 - 6	Lecture	Lab
Stream (live) and video	Introduction to Bayesian analysis Review Bayesian concepts applied to risk assessment	<u>Exercise</u> : Ecoli dose response model <u>Case Study 1A</u> – Ecoli MC <u>Case Study 2A</u> - Bayesian R– Rabies model
Sessions 7 - 8	Lecture	Lab
Stream (live) and video	Combining information and propagating uncertainty	<u>Exercise</u> : Review conjugate calculation (R) <u>Exercise</u> : E. coli (using OpenBUGS) <u>Case Study 1B</u> : OpenBUGS – E.coli model <u>Case Study 2B</u> : OpenBUGS – Rabies model Case Study 1 and 2: Discussion
Sessions 9 – 10	Lecture	Lab
Case Study Presentations		