

Hierarchical model building with Bayesian inference — Winter 2025

3-week intensive: Tuesdays and Wednesdays (14 -29 Jan): 13:30-17:00

Tuesdays in BUCH B304 & Wednesdays in CEME 1206

Professor: Elizabeth Wolkovich (e.wolkovich@ubc.ca)

Overview: Keep an eye out for an updated (and hyperlinked) syllabus on the GitHub repo.

Date	Topics	Activities
Tu Jan 14	What is Bayesian; workflow overview	Simulating data
We Jan 15	Posteriors & priors	Fitting models to simulated data
Tu Jan 21	MCMC	Diagnostics & model output
We Jan 22	Multi-level models ('random effects')	Simulate hierarchical data
Tu Jan 28	Retrodictive checks	Retrodictive checks
We Jan 29	Wrap-up & extensions	Manipulating posteriors

Design of course — This is a three-week intensive designed to walk you through one version of a modern statistical workflow (basically following this: <https://arxiv.org/abs/2408.02603>), using Bayesian inference. All the examples will be built around basic linear regression (with the option to try other approaches if you want) and will use R. You should be comfortable using R for this course. You should have some familiarity with basic linear regression, though how much training in statistics you need is not clear. Ideally, you will have learned basic through conditional probability at some point and not be too afraid of basic math equations, but you can probably brush up on these enough as the course goes along if you are motivated. The course is based around in-class learning and homework. I will teach from the board and coding in class. You'll need to be able to take notes without given slides (there are no planned course slides).

Course materials: Sample datasets — Some homework will involve using a sample dataset. I'll provide a set to choose from on the GitHub repo.

Course materials: Readings — There is no textbook, but I can refer you to two textbooks that cover most of the material in the way I teach it: *Regression and Other Stories* (ROS) by Gelman, Hill & Vehtari (more info here, including ROS online PDF) and—for multi-level modeling—*Data Analysis Using Regression and Multilevel/Hierarchical Models* by Gelman & Hill (more info here); note that I refer to this book as **ARM** or Gelman & Hill (much of the first half of ARM is in ROS).

I may recommend some chapters from *Statistical Rethinking* (SR) by MacElreath (more info here); in particular I like the chapter that explains MCMC. *Statistical Rethinking* is

a great book to read and I highly encourage you to read it if you have time; I have found it less ideal to teach from or use as a reference. Finally, *Bayesian Data Analysis* (which I call ‘BDA’), sometimes called the ‘Bible’ for Bayesian stats has a lot in it and has several editions (BDA3 means the third edition).

Office hours – Catch me after class if you need to discuss something.

Email – I check email once or twice a day between 1pm and 6pm (weekdays only). Please plan accordingly.

Missing classes – You can miss up to one class without it impacting your grade. Note that we will cover a lot in each class and you are responsible for catching up on what you miss. Since this is an intensive course, if you miss two classes (one third of the course) you cannot complete the course for credit.

University Policies – UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available [here](#).

Grading

In-class participation	60 points
Homework	40 points
Total	100 points

In-class participation: You can do well on this by arriving on time to all classes, being attentive in class, asking/answering questions and being engaged in group discussions.

Homework: There are two homework assignments due on the two Mondays after the course starts. **You must leave yourself enough time to do** them between Wednesday after class and the Monday (afternoon) deadline. They are assigned on Wednesday, based on what you have learned and take on average 6-12 hours (maybe longer depending on your level in R). You need to complete the assignment and submit your work (including graphs) to receive a good grade. I take a minimum of 5 points off for an incomplete assignment.