Short course on modelling infectious disease dynamics in R

Ankara, Turkey, November 2025

Day 1: Introduction to modelling infectious disease

Time	Session	Aims
9.30 – 10:30 AM	Lecture: Introduction to modelling infectious diseases	Introduce to core concepts of infectious diseases dynamics and the use of mathematical systems to simulate transmission
10:30 – 11:00 AM	**Break**	
11:00 – 12:30 AM	Lecture: Basic concepts of compartmental models	In this session we will go step by step in the process of designing a compartmental model. We will apply concepts of probability, proportions, hazard rates and competing hazards. We will also discuss alternatives for capturing disease events and interventions.
12:30 – 1:45 PM	**Lunch Break**	
1:45 – 3:00 PM	Practical: Demonstration of a simple compartmental model	A brief demonstration of a simple compartmental model.
3:00 – 3:30 PM	**Break**	
3:30 – 4:30 PM	Practical: Demonstration of a simple compartmental model (continued)	Participants coding their own cohort model Rate calculations and interpretation of model output will be put in practice.

Day 2: The SIR model

Time	Session	Aims
9.30 – 10:30 AM	Lecture: The SIR model	Understand why the SIR model is at the core of infectious disease dynamics. In its simplicity, SIR models are the gate to introduce more complex concepts like the basic reproductive number (R0) and herd immunity.
10:30 – 11:00 AM	**Break**	
11:00 – 12:30 AM	Lecture: Understanding epidemic phases with an SIR model	Cover the mathematical expressions governing the SIR model. In practice, we will use R to understand an SIR model, understanding model variables, and model parameters.
12:30 – 1:45 PM	**Lunch Break**	
1:45 – 3:00 PM	Practical: Building blocks of an SIR	Participants will code an SIR model and will gather information to inform the main model parameters.
3:00 – 3:30 PM	**Break**	
3:30 – 4:30 PM	Practical: Introducing transmission dynamics	Using the previously coded SIR model we will add complexity by examining the role of R0, Reff and see practically how herd immunity can be established for a simple SIR model

Day 3: Stochastic models and assessing uncertainty

Time	Session	Aims
9.30 – 10:30 AM	Lecture: Introduction to stochastic models 1	Introduce concepts of stochasticity and its relevance for understanding epidemic surge and probability of extinction
10:30 – 11:00 AM	**Break**	
11:00 – 12:30 AM	Lecture: Introduction to stochastic models 2	Cover types of stochastic models and modelling procedures
12:30 – 1:45 PM	**Lunch Break**	
1:45 – 3:00 PM	Lecture: Assessing model uncertainty and calibration	Explore uncertainty and methods to assess it in modelling
3:00 – 3:30 PM	**Break**	
3:30 – 4:30 PM	Practical: Explore stochasticity in a simple SIR model	Using a simple SIR model coded before, a stochastic process will be introduced and its output explored.

Day 4: Outbreaks and data

Time	Session	Aims
9.30 – 10:30 AM	Lecture: Introduction to outbreak analysis	Cover estimation of key delays (e.g. incubation period, serial interval), the estimation of growth rates, doubling times, of the basic reproduction number and simple short-term forecasting
10:30 – 11:00 AM	**Break**	
11:00 – 12:30 AM	Lecture: Using outbreak	Understand principles of collecting and using outbreak data and linelist
12:30 – 1:45 PM	**Lunch Break**	
1:45 – 3:00 PM	Practical: Outbreak data	Load, clean and analyse synthetic outbreak data
3:00 – 3:30 PM	**Break**	
3:30 – 4:30 PM	Practical: Outbreak estimates	Introduce tools and methods for producing estimates of serial interval and R0

Day 5: Final assignment and wrap-up

Time	Session	Aims
9.30 – 10:30 AM	Practical Final assignment Part 1	Introduce the final project and hands-on working time
10:30 – 11:00 AM	**Break**	
11:00 – 12:30 AM	Practical: Final assignment Part 2	Complete assignment and prepare for group report back
12:30 – 1:45 PM	**Lunch Break**	
1:45 – 3:00 PM	Group activity	Groups report back on final assignment
3:00 – 3:30 PM	**Break**	
3:30 – 4:15 PM	Final lecture: How did we model COVID-19?	Review the evidence of what we know about COVID-19 and how to translate this into a mathematical model
4:15 – 4:30 PM	Wrap-up	