

Iowa Modelling Course Tutorial 1: Designing a mathematical model for bovine TB: (45 minutes)

Outline: The aim of this tutorial is to become familiar with the process of designing mathematical models for infectious disease in livestock and the decision making process along the way. We chose a complex disease for illustrating that there are many ways to generate a model, with some better than others.

Tasks: 1. Design a conceptual mathematical model that predicts the impact of genomic selection of cattle for greater resistance to bTB on future bTB incidence. Follow the decision making process outlined below. Prepare a 5 minute presentation of your model to the group.

Tip: Remember to apply the principle of Ockham's razor! Also, keep track of the assumptions you need to make along the way.

1. What is the **scope** of your model (e.g. herd, national cattle system, cattle and surrounding wildlife etc.) and at what **level** and **over what time span** will you represent the dynamic processes (e.g. individual animal, herd, region)?
2. What **demographic information / structure** should be included? (e.g. herd size, stratification by e.g. age, infection status)
3. What are **your model outputs**? (e.g. what kind of numbers, tables, graphs)
4. What **type of model** is most appropriate for this purpose? (e.g. deterministic, stochastic, hybrid,...)
5. Which **dynamic processes** will be described in the model? (e.g. birth, death, infection, animal movement etc.)
6. What **transmission routes** should be considered?
7. Provide a **flow diagram** that illustrates the flow of animals and the infection
8. How / where can you **incorporate genetic information** in this model diagram?
9. How / where can you **incorporate information about the diagnostic test**?
10. What are your **model inputs, variables and parameters**?
11. What kind of **data** will you need to **parameterize and validate** the model?

Task 2. Present your model and act as a member of the assessment panel:

12. What are the strengths and weaknesses of the different models?