Epidemix

An online tool to make modelling more accessible

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Communicating model outcomes

- Negative perception of utility of models for guiding policy or research
  - Limited appreciation of assumptions
- Subject to unrealistically high expectations
  - Not in line with what models can deliver

Purpose

- To learn about
  - Key concepts of infectious disease dynamics and control
  - Impact of modelling assumptions on disease patterns
- To develop hands-on practicals for students and non-specialists

Principles

- Easy-to-use
- Knowledge in mathematics: not a pre-requisite
- Step-by-step model specification
  - no need to read a user manual
  - conditionality
- Interactive interface and output visualization

Implementation

- RStudio Shiny
- Separation between interface and model computation
- Extended using JavaScript and CSS
  - Dynamic graph outputs

epidemix

Epidemix is a free web application that allows users from different backgrounds to improve their understanding of mathematical disease modelling. Use Epidemix to explore key concepts of disease dynamics and control, and to explore how different types of models can be used to examine the spread of diseases in different populations.

Access Epidemix

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Select model type

Generic — Disease-specific

Deterministic Homogeneous COMP

Download parameters | Upload parameters

Load pre-defined parameters

Specify details of the model parameters below.

Reset parameters

Select infection states to consider

Current selection

S , Is , R

All infected units recover from infection

Removed units are not replaced (closed population selected)

A unit which recovered from infection remains immune until removed

Edit

Define host population features

Current selection

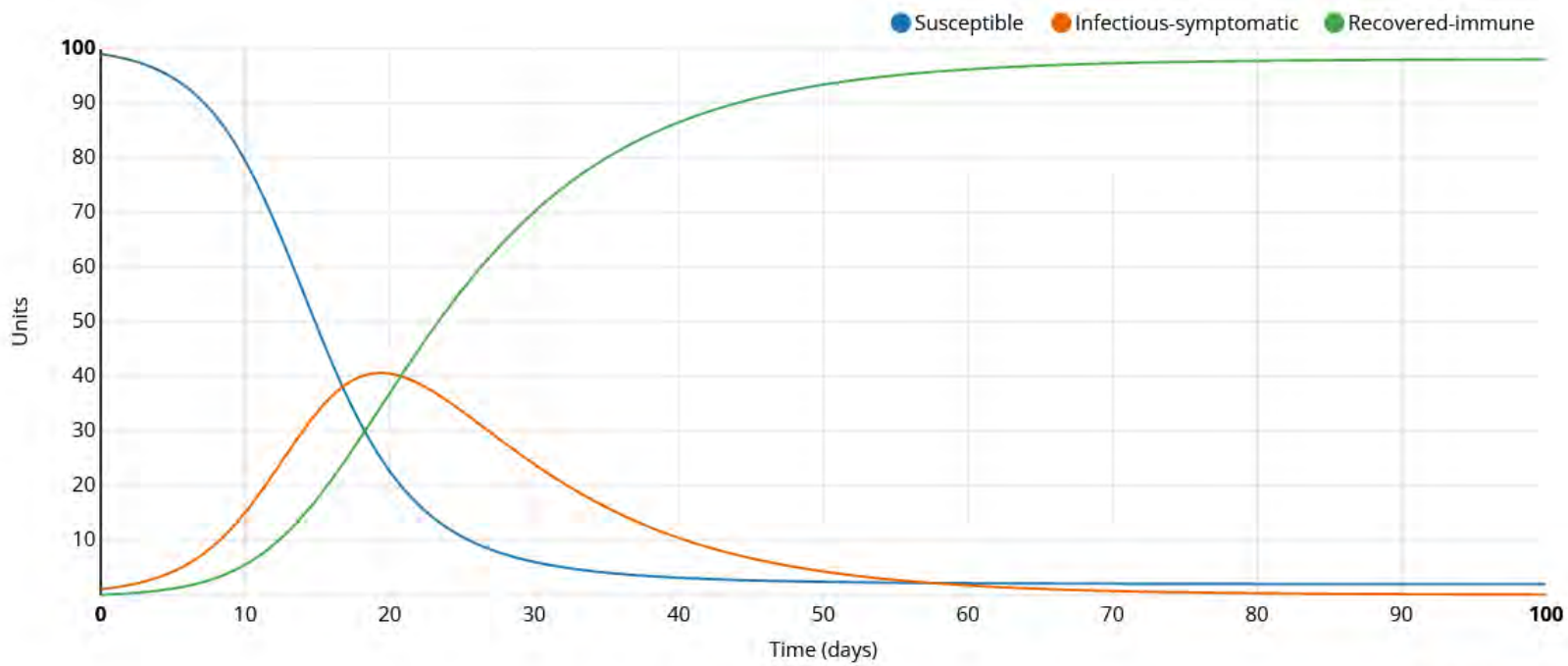
Population size = 100

Closed population

Edit

Visualisation | Data table | Parameter compare

The graph shows the number of units in each infection state over time. The time is expressed in days on the x-axis.
Click on the infection states below to select or unselect them.
Roll over the lines to get the number of units per infection state for a given time.



Export PNG

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Model selection – 9 models

- Deterministic *vs* Stochastic
- Compartmental *vs* Individual-based
- Random *vs* Heterogeneous mixing

(two-groups, meta-population, network, spatial)

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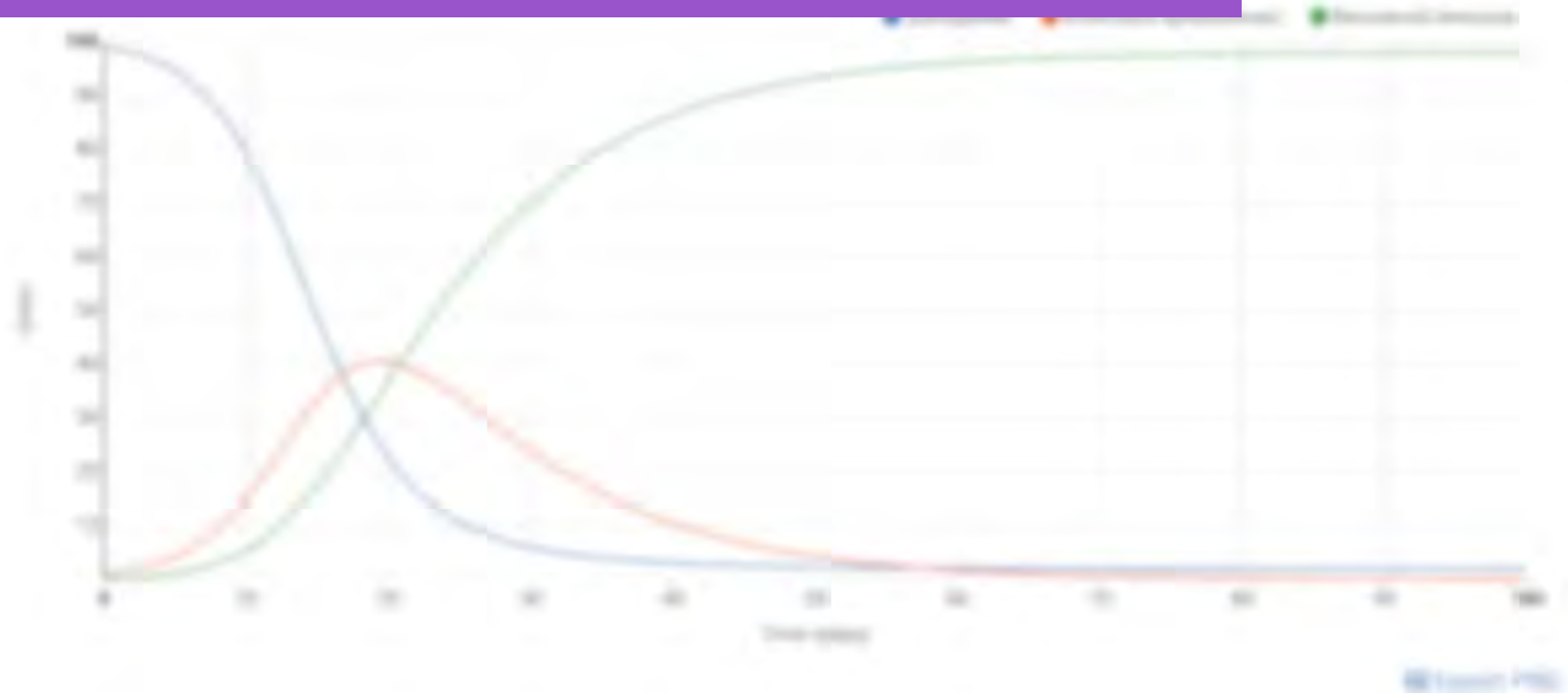

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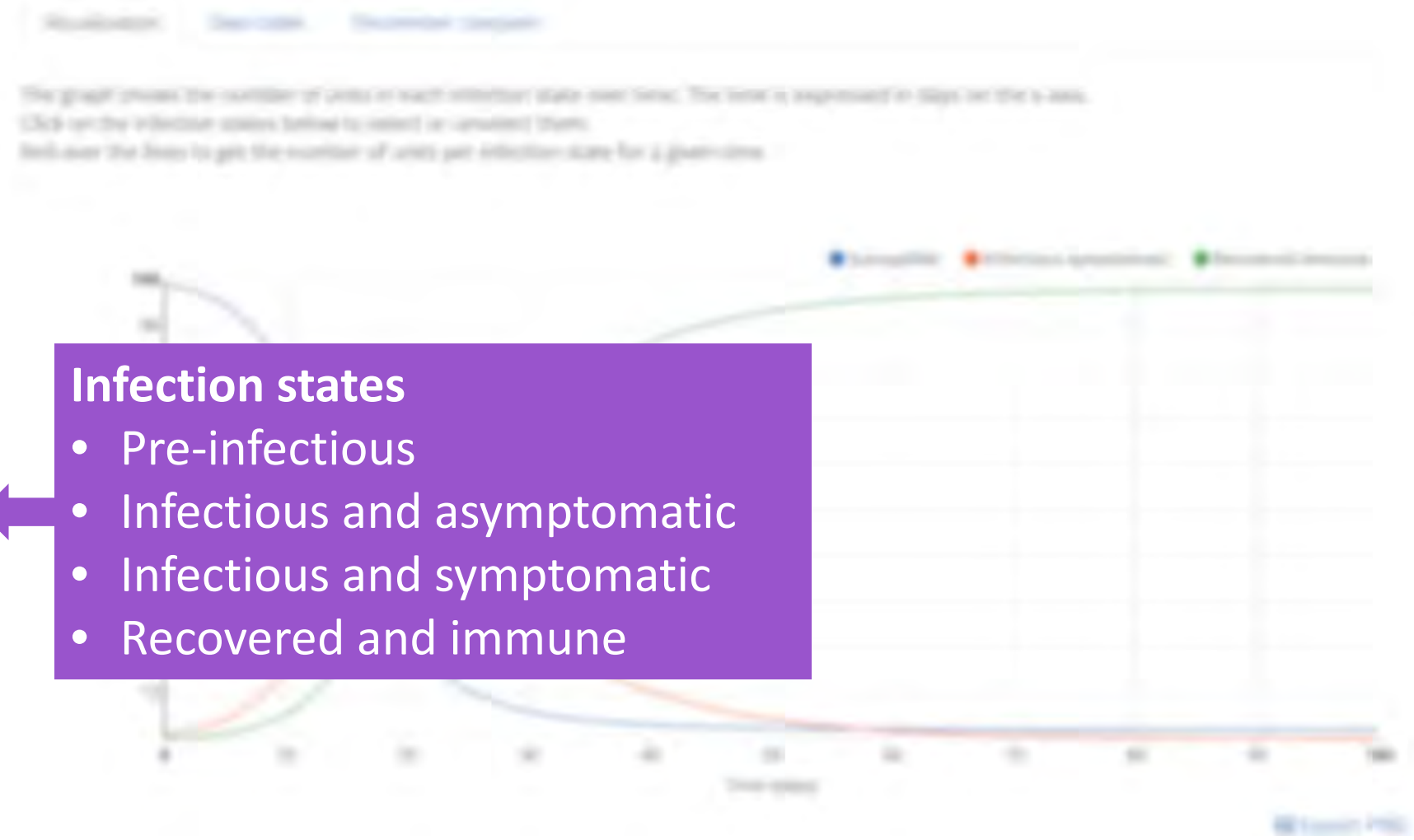

Infection states

- Pre-infectious
- Infectious and asymptomatic
- Infectious and symptomatic
- Recovered and immune

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Deterministic Homogeneous COMP

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Closed population

Edit

Parameters

- Host population

(e.g. *n*, open/closed)

- Transmission and infection

(e.g. transmission rate, infectious period, waning immunity)

- Control strategy

(vaccination, culling)

- Simulation parameters

(length, no of simulations)

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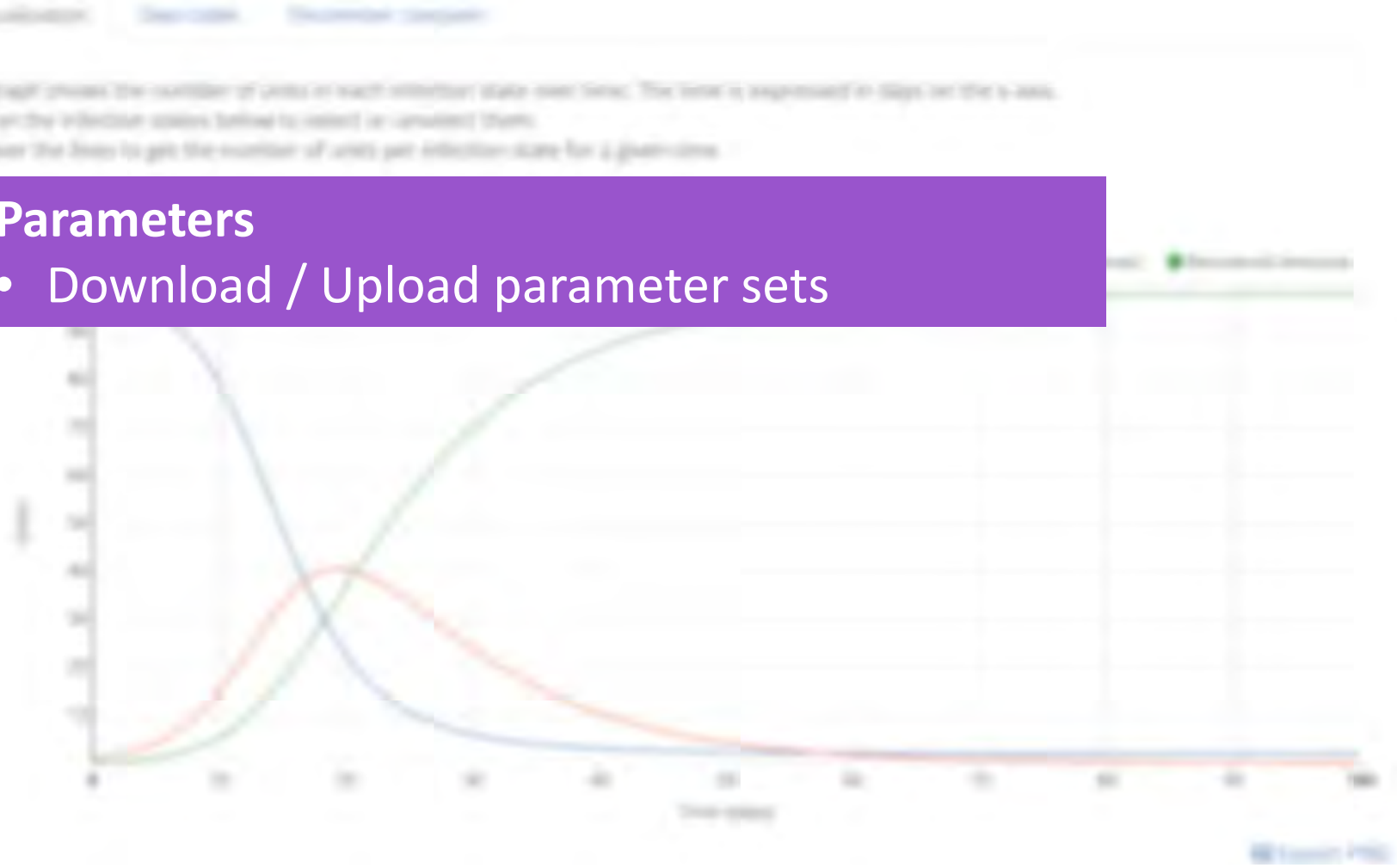
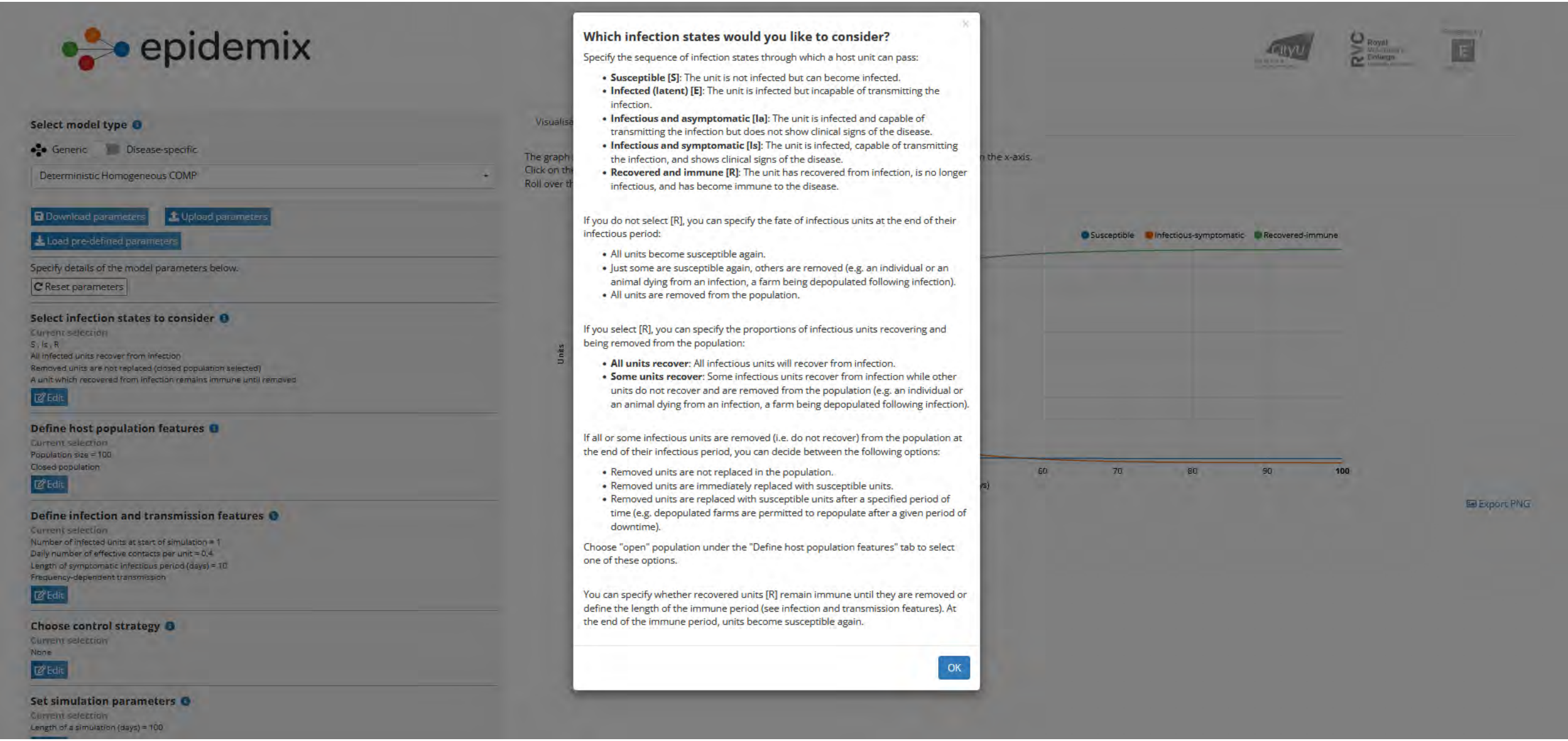
Closed population

Edit

Parameters

- Download / Upload parameter sets

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Current selection
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Edit
Define host population features
Current selection
Population size = 100
Closed population
Edit
Define infection and transmission features
Current selection
Number of infected units at start of simulation = 1
Daily number of effective contacts per unit = 0.4
Length of symptomatic infectious period (days) = 10
Frequency-dependent transmission
Edit
Choose control strategy
Current selection
None
Edit
Set simulation parameters
Current selection
Length of a simulation (days) = 100
Which infection states would you like to consider?
Specify the sequence of infection states through which a host unit can pass:
Susceptible [S]: The unit is not infected but can become infected.
Infected (latent) [E]: The unit is infected but incapable of transmitting the infection.
Infectious and asymptomatic [Ia]: The unit is infected and capable of transmitting the infection but does not show clinical signs of the disease.
Infectious and symptomatic [Is]: The unit is infected, capable of transmitting the infection, and shows clinical signs of the disease.
Recovered and immune [R]: The unit has recovered from infection, is no longer infectious, and has become immune to the disease.
If you do not select [R], you can specify the fate of infectious units at the end of their infectious period:
All units become susceptible again.
Just some are susceptible again, others are removed (e.g. an individual or an animal dying from an infection, a farm being depopulated following infection).
All units are removed from the population.
If you select [R], you can specify the proportions of infectious units recovering and being removed from the population:
All units recover: All infectious units will recover from infection.
Some units recover: Some infectious units recover from infection while other units do not recover and are removed from the population (e.g. an individual or an animal dying from an infection, a farm being depopulated following infection).
If all or some infectious units are removed (i.e. do not recover) from the population at the end of their infectious period, you can decide between the following options:
Removed units are not replaced in the population.
Removed units are immediately replaced with susceptible units.
Removed units are replaced with susceptible units after a specified period of time (e.g. depopulated farms are permitted to repopulate after a given period of downtime).
Choose "open" population under the "Define host population features" tab to select one of these options.
You can specify whether recovered units [R] remain immune until they are removed or define the length of the immune period (see infection and transmission features). At the end of the immune period, units become susceptible again.
OK
Susceptible
Infectious-symptomatic
Recovered-immune
Units
60
70
80
90
100
Export PNG
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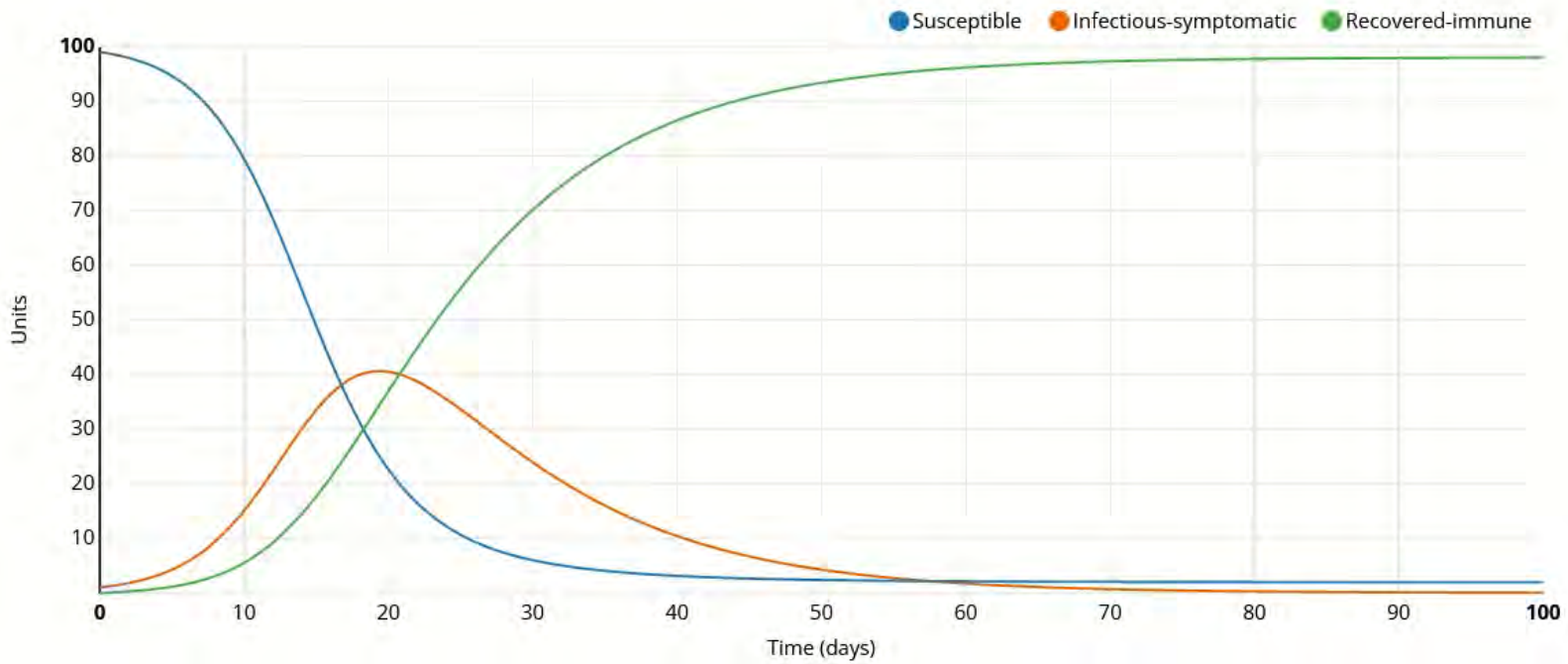

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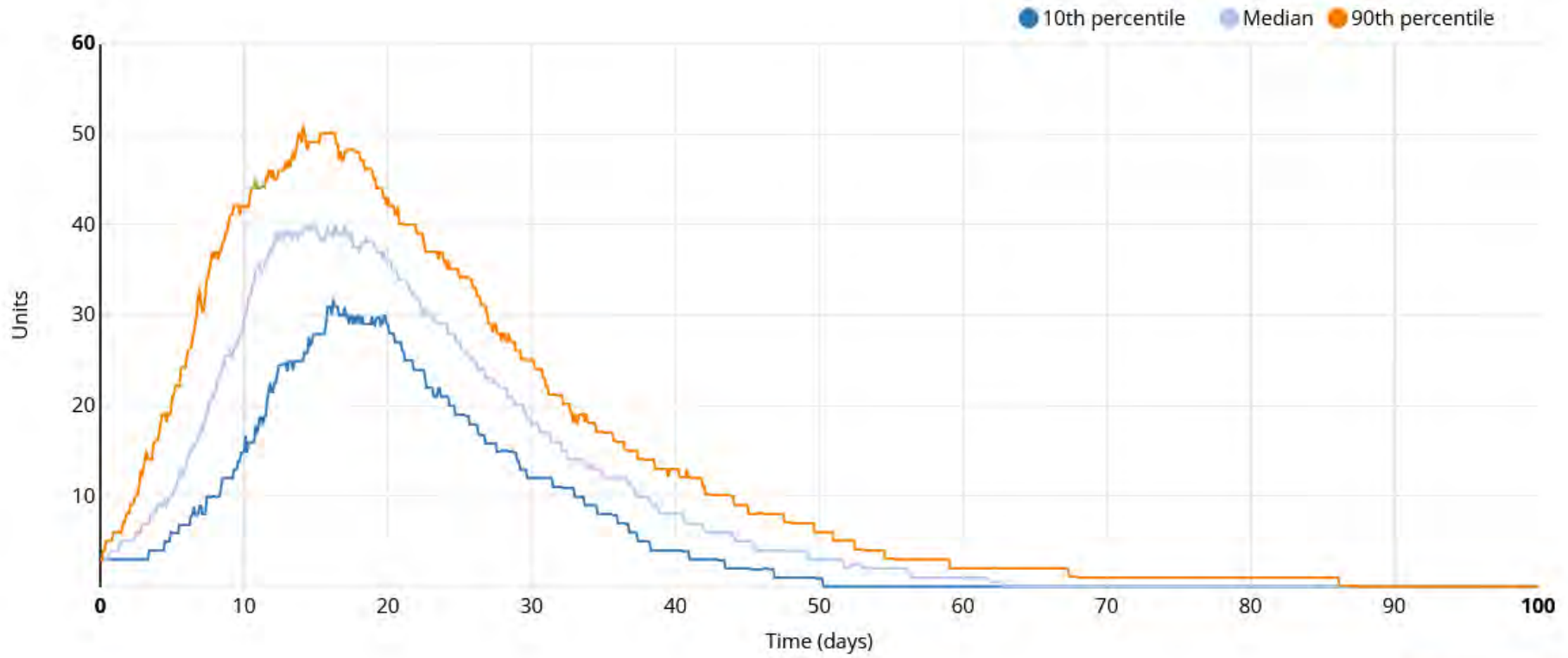
Visualisation | Data table | Parameter compare

Show median | Investigate variability | Explore individual simulations

Choose infection state

Infectious symptomatic



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Upload edgelist (csv file)

Upload edgelist

Click here to download a csv template

Infection states

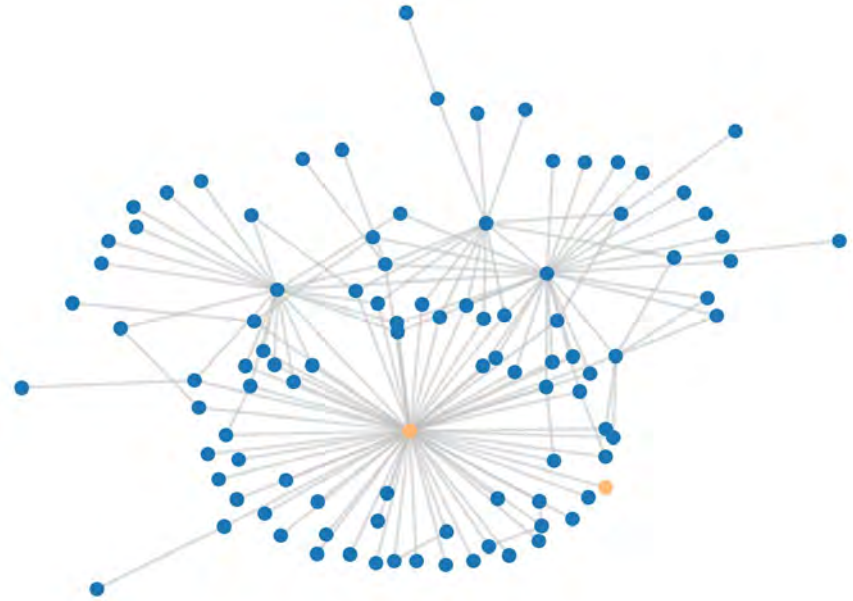
- Susceptible
- Infectious symptomatic
- Recovered and immune

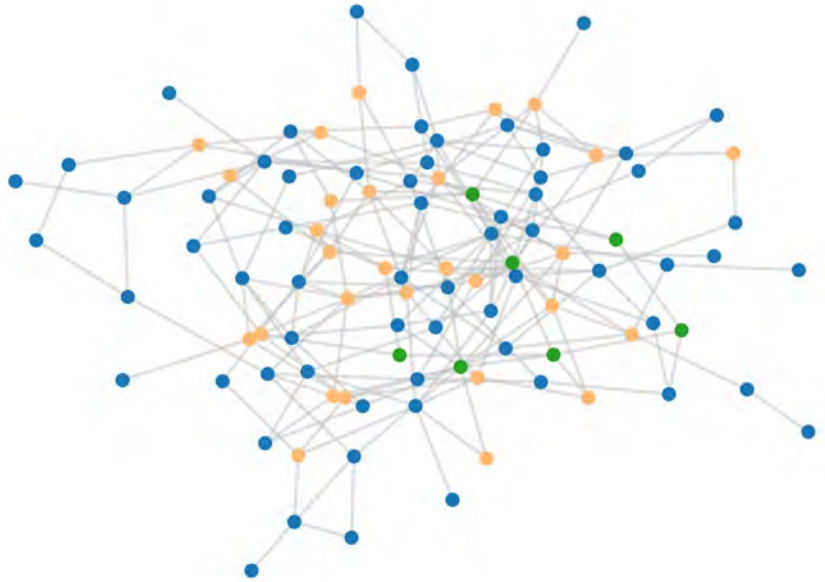
Upload spatial coordinates (csv file)

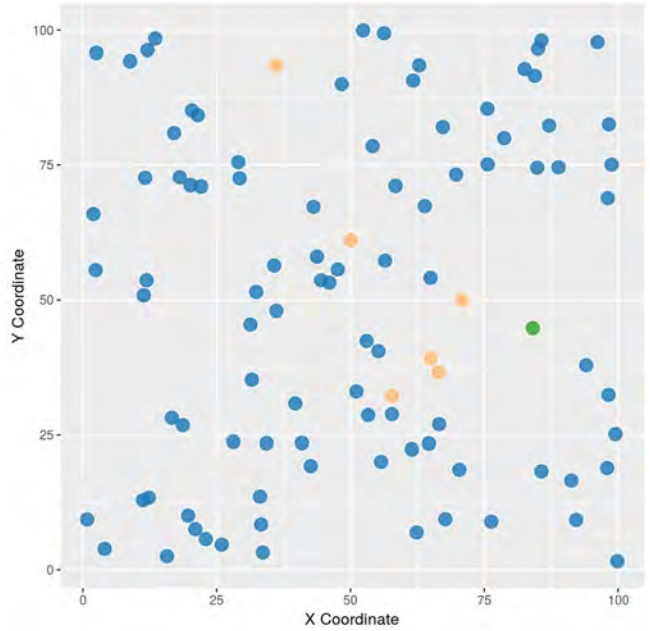
Longitude/Latitude X/Y in Grid

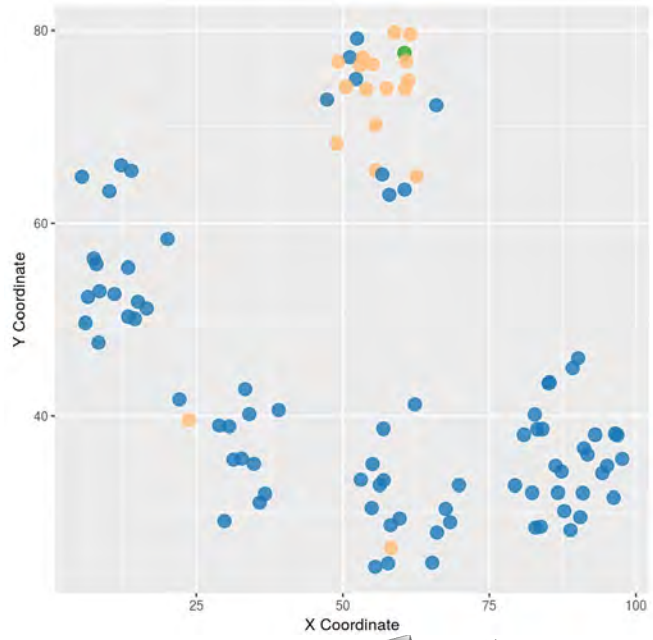
Upload coordinates

Click here to download a csv template









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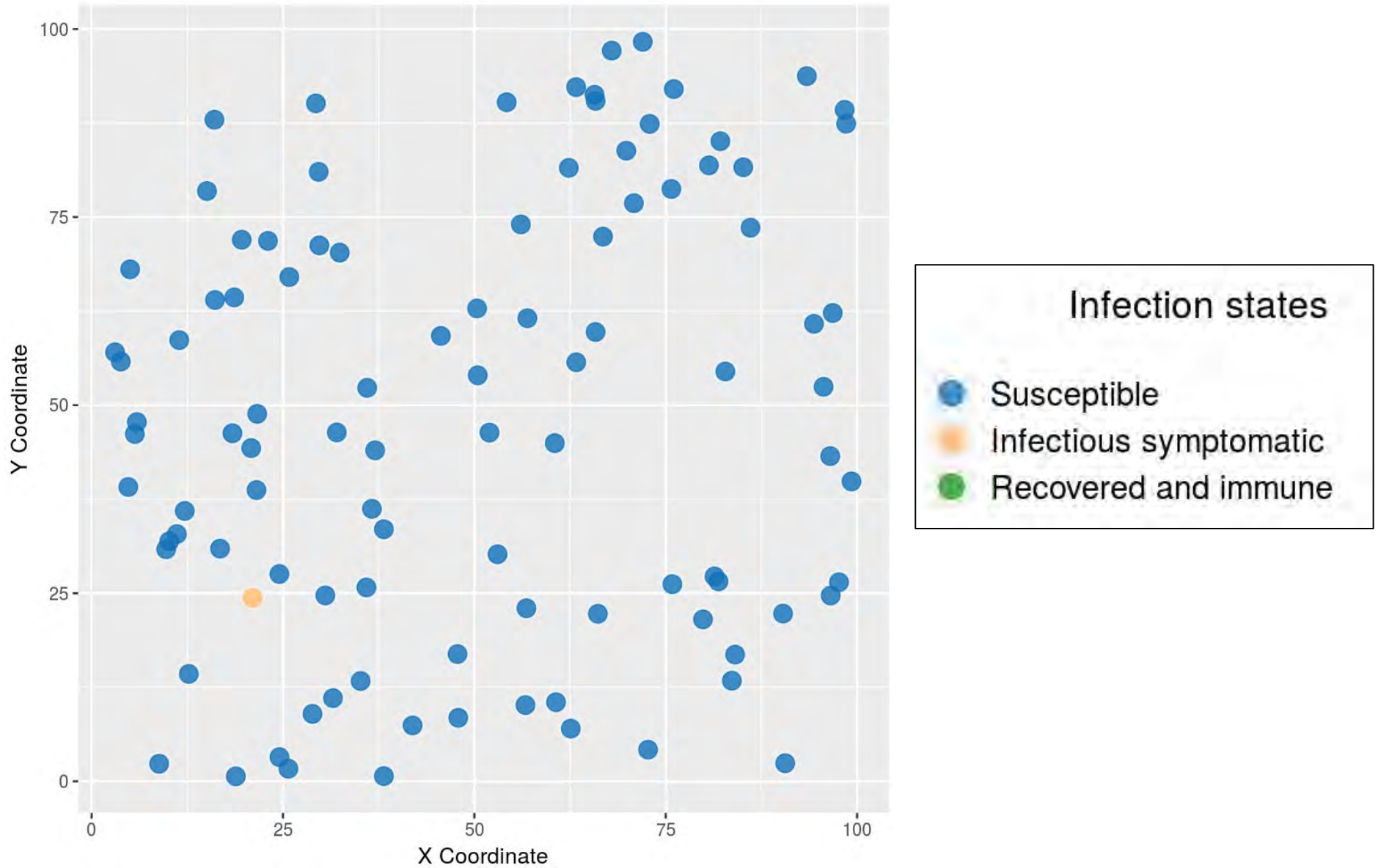
100
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Y Coordinate
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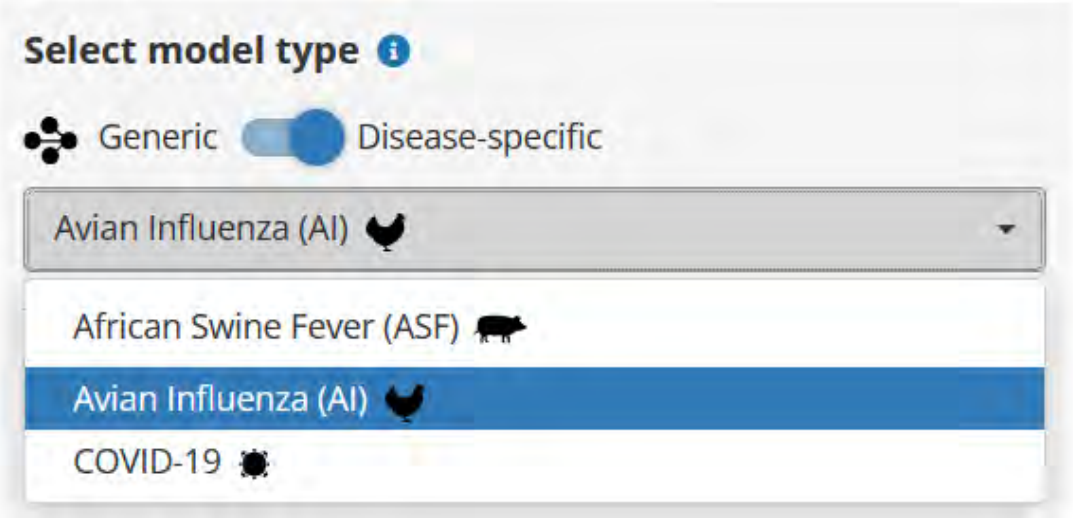
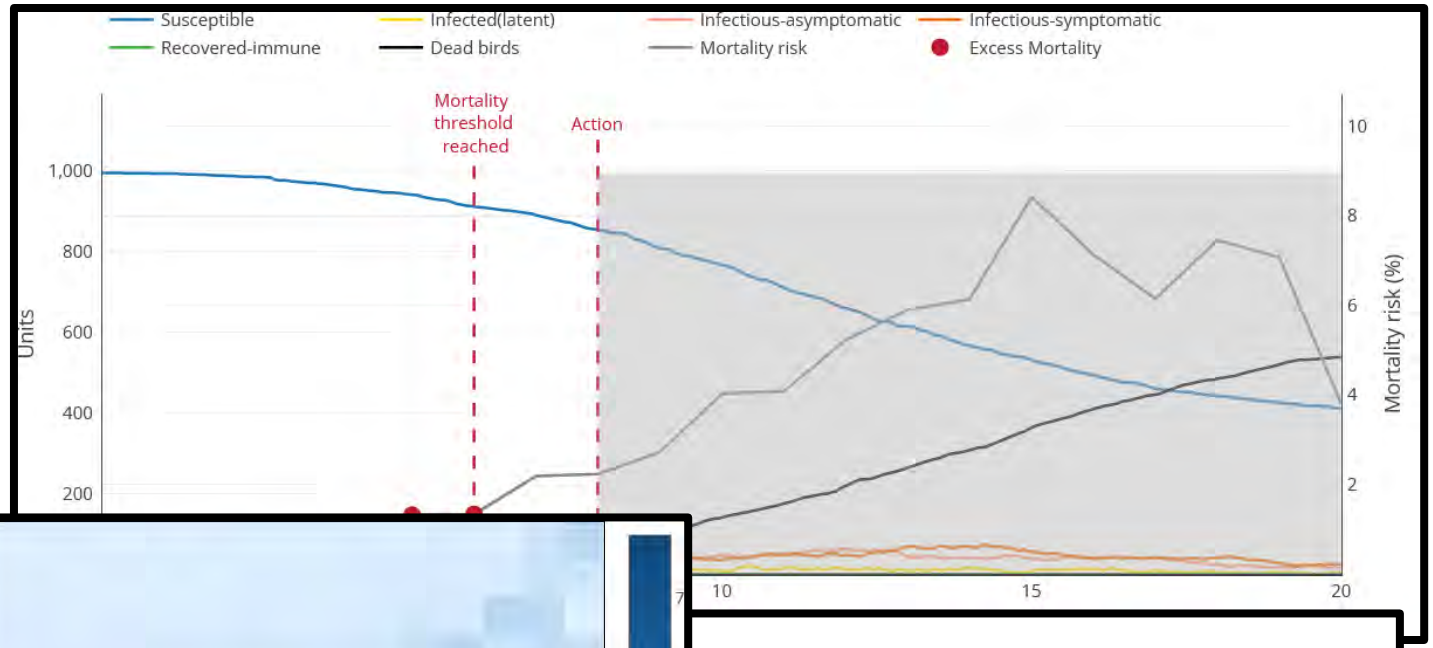
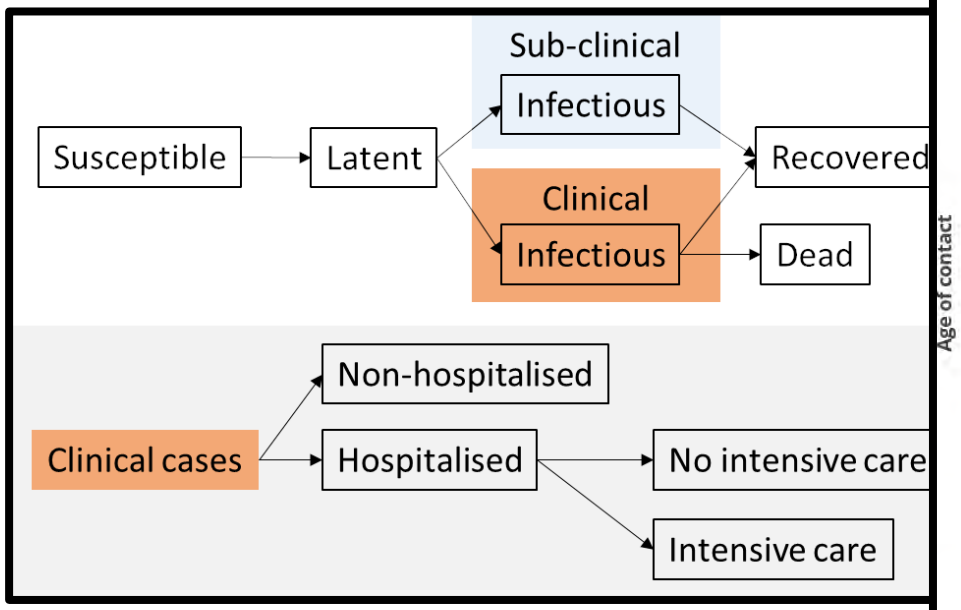
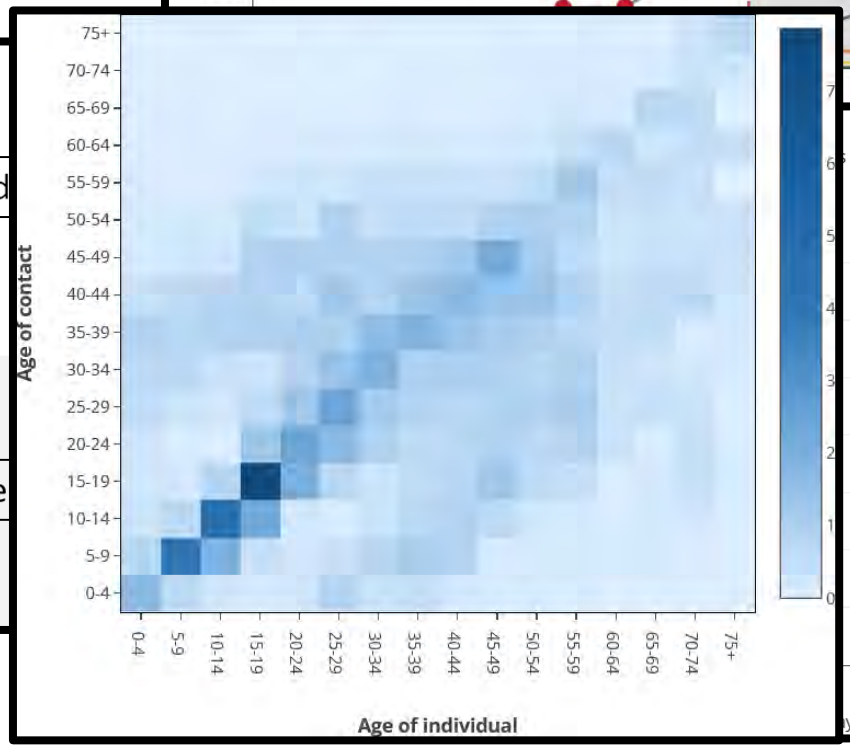
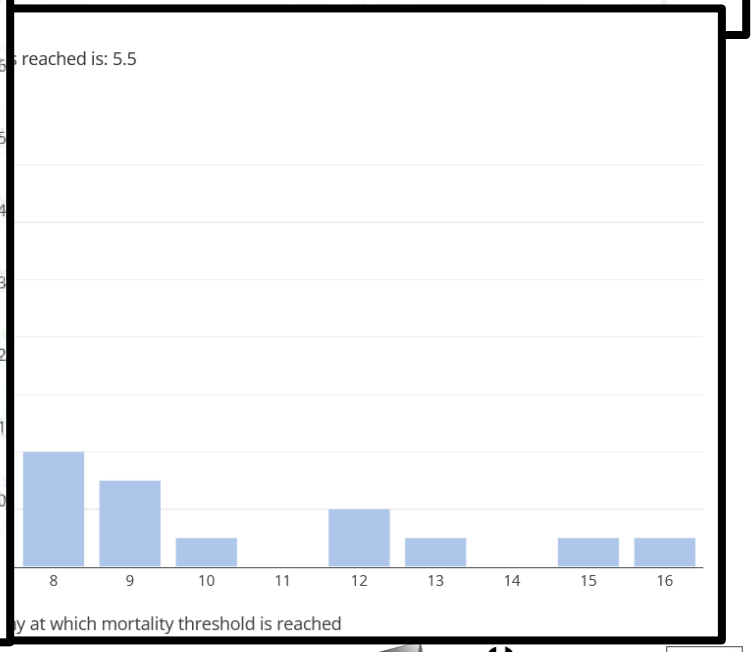
75
100
X Coordinate
Infection states
Susceptible
Infectious symptomatic
Recovered and immune











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Next steps

- Expanding model library/functions
- Improving performance
- Tutorials

- Errors, please get in touch

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Resources

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