Indicative solution of the Pneumonic Plague case (EN)

dr. Erik Pruyt

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[Case questions 1 and 2:] First students are required to make a simple System Dynamics simulation model (see Figure 1(a)) of a local pneumonic plague epidemic, as well as a corresponding complete '*causal loop diagram*' (see Figure 1(b)).

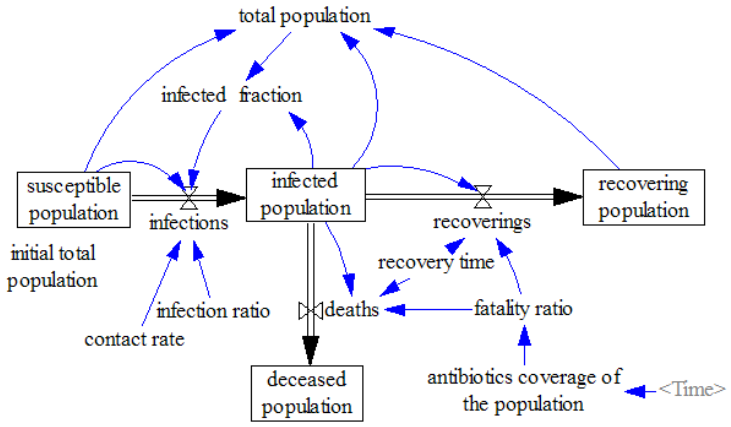
[Case question 3:] They need to simulate the model and make graphs of the evolution of the *infections*, the *deaths*, the *recovering population*, and the *deceased population* (see Figure 1(c)).

[Case question 4:] Then they need to extend the model to take the social dynamics during an outbreak of an extremely contagious and lethal illness such as pneumonic plague into account: in this case that means an automatic drop in the *contact rate* caused by illness and anxiety (see Figure 2(a)), and make graphs of the evolution of the *infections*, the *deaths*, the *recovering population*, and the *deceased population* (see Figure 2(b)). They also need to recognise that the dynamics changes a little bit, but that this does not change the overall picture.

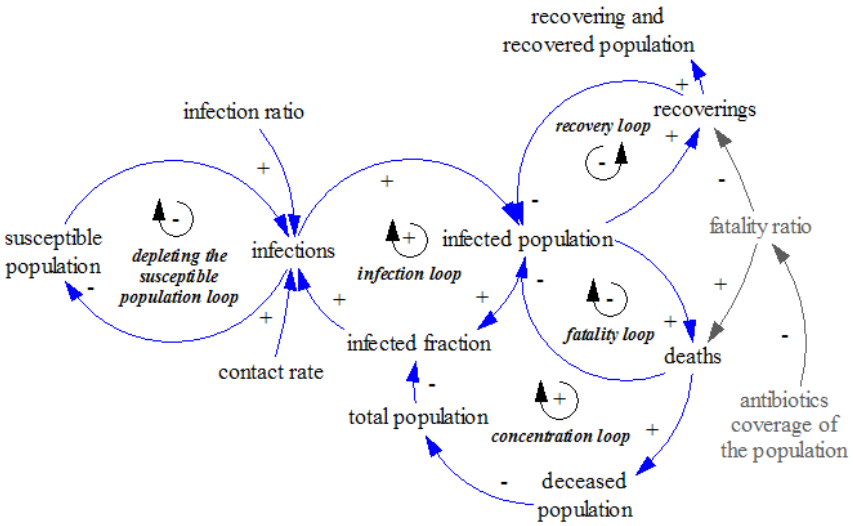
[Case question 5 and 6:] Students then have to validate the model and test the sensitivity of the model for small changes in the *normal contact rate*, the *impact of the infected fraction on the contact rate*, and another variable of choice.

[Case questions 7 and 8:] Finally they need to test whether an increasing supply of *antibiotics* leads to a lower number of fatalities (see Figure 2(c)) and whether the epidemics can be stopped.

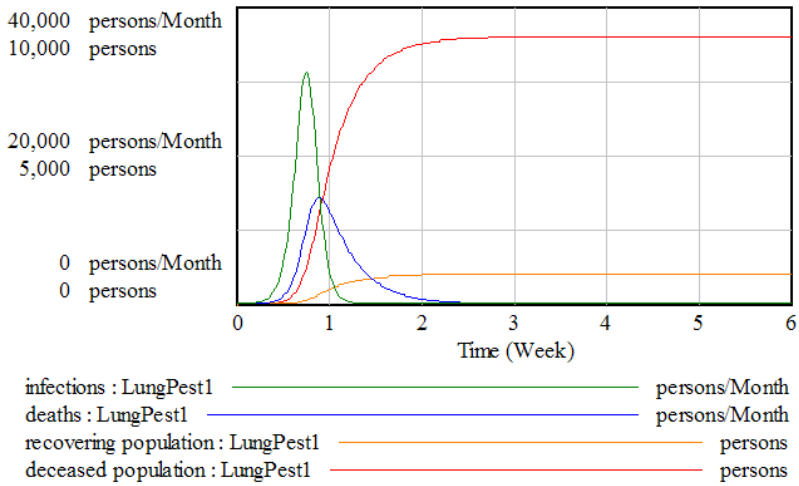
Building blocks addressed in this case include stock-flow modelling and causal loop diagramming of aging chains, formulating special functions (lookup functions and time series), and exploring model and policy behaviour. The basic Pneumonic Plague model is available at `http://forio.com/simulate/simulation/e.pruyt/lungpest-in-china`).



(a) Stock-Flow Diagram of the basic Pneumonic Plague model

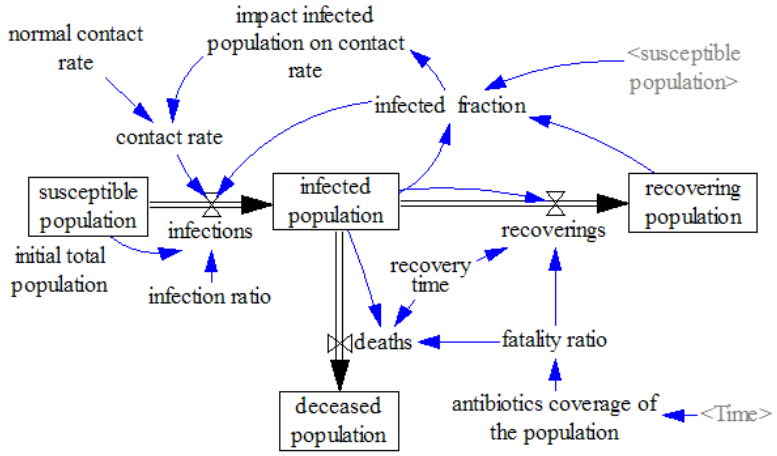


(b) Causal-Loop Diagram of the basic Pneumonic Plague model

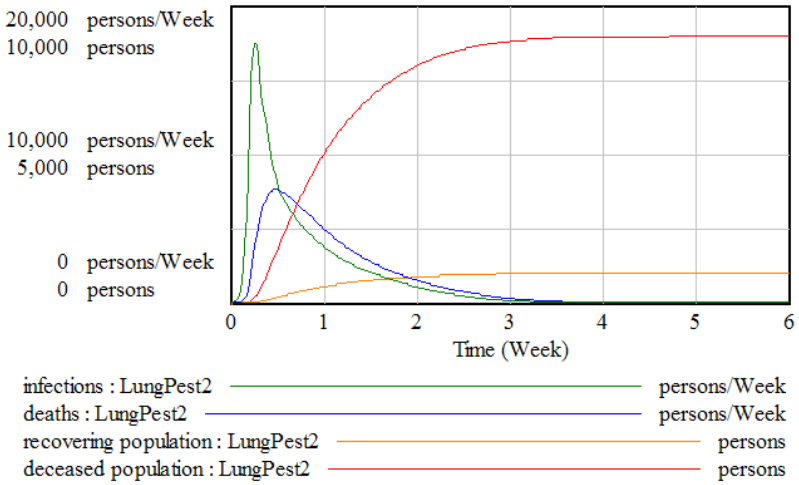


(c) Behaviour of the basic Pneumonic Plague model

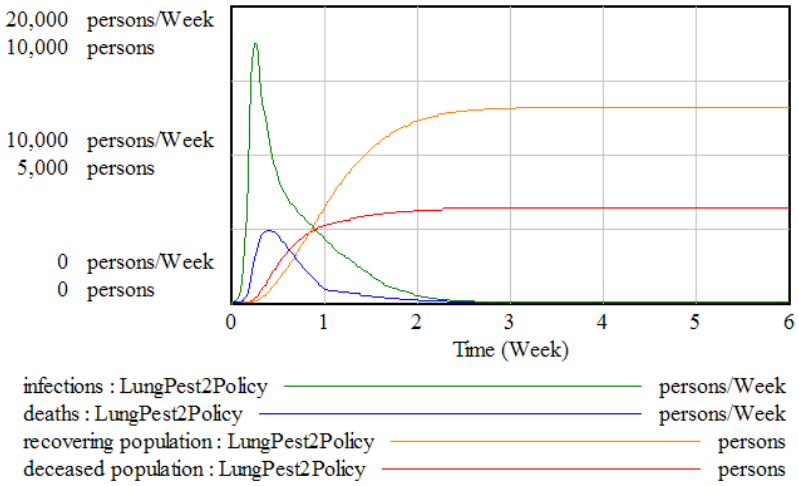
Figure 1: SFD, complete CLD and behaviour of the basic Pneumonic Plague model



(a) Stock-Flow Diagram of the extended Pneumonic Plague model



(b) Behaviour of the extended Pneumonic Plague model



(c) Behaviour of the extended Pneumonic Plague model in case of a linear increase of the antibiotics coverage

Figure 2: SFD and behaviour of the extended Pneumonic Plague model, without/with supply of antibiotics