

Example Model Description

Can the Malagasy black rat (*Rattus rattus*) population independently maintain transmission of the bacterium, *Yersinia pestis*, responsible for human plague?

Susceptible juvenile rats enter the population through birth, at rate b , which is influenced by the proportion of uninfected (susceptible) adult rats in the population at a given time. Juvenile rats age into the adult class, on average $1/\omega$ time units after they are born. Both juvenile and adult susceptible rats can be infected by contact with infectious rats of any age, based on a force of infection proportional to the prevalence of infectious rats in the population. Once infected, rats enter the exposed class. The incubation period is $1/\sigma$ time units (on average), after which the animals develop clinical plague, which is equivalent to transitioning from the exposed class to the infectious class. A subset of rats recover from plague to become immune, based on rate γ . All rats in the population experience background mortality with hazard μ , and infectious rats experience an additional disease-induced hazard of mortality, α .