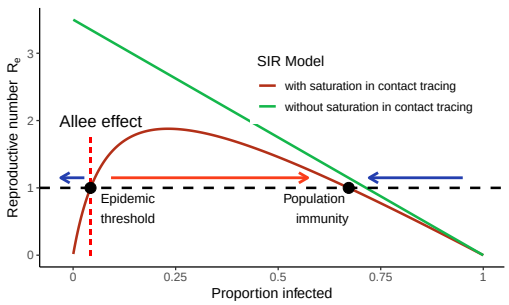
a

Non-pharmaceutical interventions (NPIs) induce an Allee effect on disease dynamics

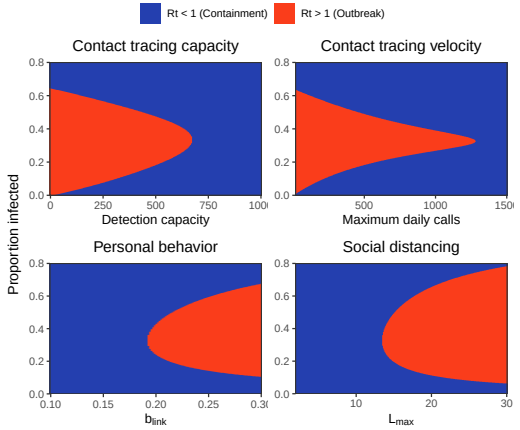
$$R_e = P_{susceptible} \cdot b_{link}(L \cdot f_q + L_{max} \cdot f_{nq})$$

Personal behavior | Contact tracing | Social distancing



b

Transition between dynamic states is determined by the strength of NPIs and the proportion of infected individuals



c

Simulated dynamics with an NPI-induced Allee effect often show sharp accelerations after slow initial spread

Simulated SIR Dynamics

$$S(t+1) = S(t) - I_{new}(d) \qquad I_{new}(t) \sim \text{Poisson}(\lambda)$$
$$I(t+1) = I(t) + I_{new}(t) - \frac{I(t)}{\gamma(I(t))} + I_{imp}(t) \qquad \lambda = \frac{\beta(I(t))I(t)^p S(t)}{N}$$
$$R(t+1) = R(t) + \frac{I(t)}{\gamma(I(t))} \qquad I_{imp}(t) \sim NB(\mu, \sigma)$$