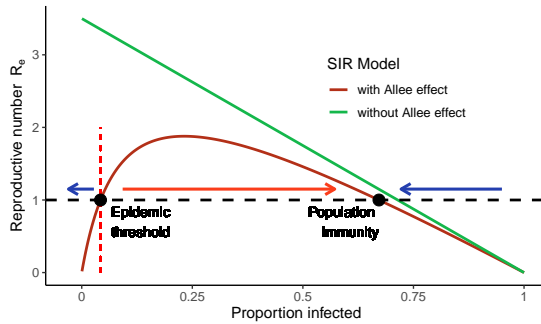


Non-pharmaceutical interventions (NPIs)
induce an Allee effect on disease dynamics

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



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

Simulated SIR Dynamics

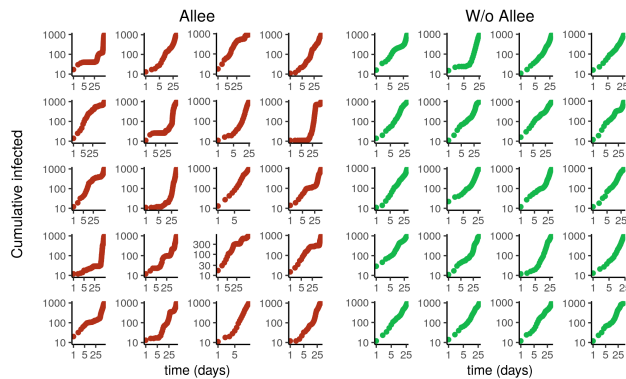
$$S(t+1) = S(t) - I_{new}(t)$$

$$I(t+1) = I(t) + I_{new}(t) - \frac{I(t)}{\gamma(I(t))} + I_{imp}(t)$$

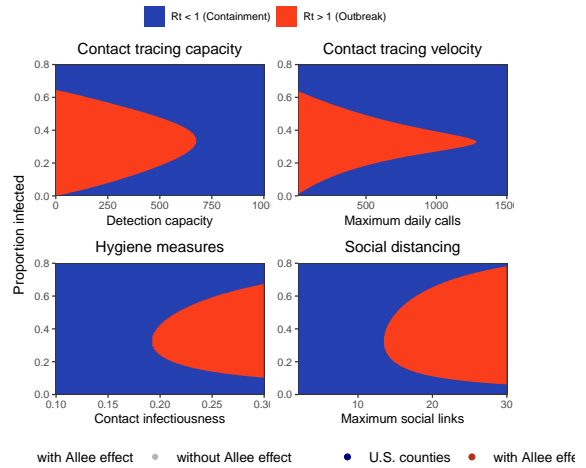
$$R(t+1) = R(t) + \frac{I(t)}{\gamma(I(t))}$$

$$I_{new}(t) \sim \text{Poisson}(\lambda), \lambda = \frac{\beta(I(t))I(t)PS(t)}{N}$$

$$I_{imp}(t) \sim \text{NB}(\mu, \sigma)$$



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



with Allee effect • without Allee effect • U.S. counties • with Allee eff

