$$\frac{dS}{dt} = -\beta_1 \cdot S(I_1 + I_{2,1}) - \beta_2 \cdot S(I_2 + I_{1,2})$$

$$\frac{dE_1}{dt} = \beta_1 \cdot S(I_1 + I_{2,1}) - \kappa_1 E_1 \qquad \frac{dE_2}{dt} = \beta_2 \cdot S(I_2 + I_{1,2}) - \kappa_2 E_2$$

$$\frac{dI_1}{dt} = \kappa_1 E_1 - \delta_1 I_1 \qquad \frac{dI_2}{dt} = \kappa_2 E_2 - \delta_2 I_2$$

$$\frac{dR_1}{dt} = \delta_1 I_1 - \eta_1 R_1 \qquad \frac{dR_2}{dt} = \delta_2 I_2 - \eta_2 R_2$$

$$\frac{dS_{1,2}}{dt} = -\beta_2 \cdot S_{1,2}(I_2 + I_{2,1}) + \eta_1 R_1 \qquad \frac{dS_{2,1}}{dt} = -\beta_1 \cdot S_{2,1}(I_1 + I_{1,2}) + \eta_2 R_2$$

$$\frac{dE_{1,2}}{dt} = \beta_2 \cdot S_{1,2}(I_2 + I_{2,1}) - \kappa_2 E_{1,2} \qquad \frac{dE_{1,2}}{dt} = \beta_1 \cdot S_{2,1}(I_1 + I_{1,2}) - \kappa_1 E_{2,1}$$

$$\frac{dI_{1,2}}{dt} = \kappa_2 E_{1,2} - \delta_2 I_{1,2} \qquad \frac{dI_{2,1}}{dt} = \kappa_1 E_{2,1} - \delta_1 I_{2,1}$$

$$\frac{dR}{dt} = \delta_2 I_{1,2} + \delta_1 I_{2,1}$$

Assumptions:

- No coinfection
- Once recovered, not susceptible to same infection
- Same infection rate in recovered and naïve
- When infected with 1 virus and then recovered, your susceptibility to another virus changes

S = susceptible to both

E_1 = Exposed to RSV

I_1 = Infected with RSV

R_1 = Recovered from RSV, susceptibility to COVID dependent on interference

$S_{1,2}$ = Recovered from RSV, susceptible to COVID

$E_{1,2}$ = Recovered from RSV, susceptible to COVID

$I_{1,2}$ = Recovered from RSV, infected with COVID

R = recovered from both

E_2 = Exposed to COVID

I_2 = Infected with COVID

R_2 = Recovered from COVID, susceptibility to RSV dependent on interference

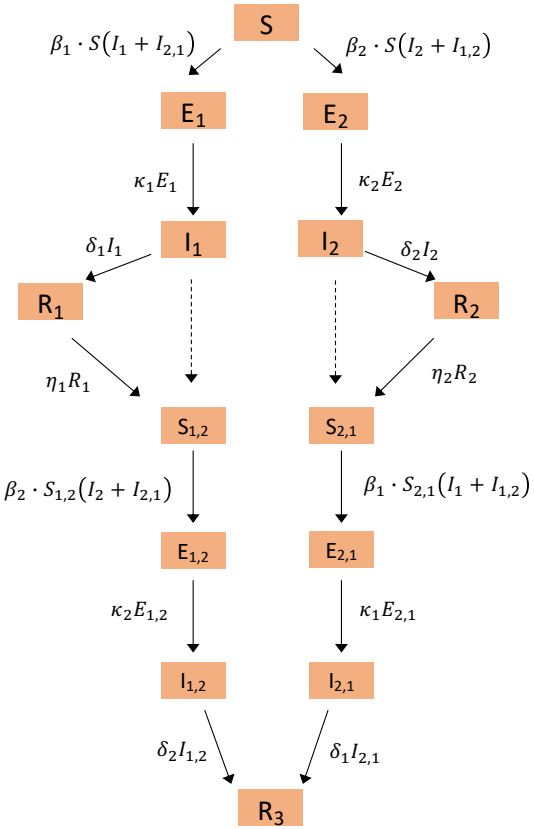
η_1 = rate of becoming susceptible to COVID after recovery from RSV

η_2 = rate of becoming susceptible to RSV after recovery from COVID

$S_{2,1}$ = Recovered from COVID, susceptible to RSV

$E_{2,1}$ = Recovered from COVID, susceptible to RSV

$I_{2,1}$ = Recovered from COVID, infected with RSV



Questions

- How to account for latency / recovery? Do we need the separate R terms? Should we scale the conversion from susceptible to exposed with the second virus? What happens if we do both?
- Viral interference / latency in general, do we need coinfection?
- Do we want to include flu?
- What data would be optimal for this?
- How do we do the next step?
- How to find the best parameters?