

COVID-19 Model Containing Contact Tracing and Quarantine

1 Model Equations

$$\begin{aligned}\frac{dS}{dt} &= -S\beta \left(\frac{I_P + b_C I_C + b_A I_A + \phi Q}{N} \right) + \pi_S \delta_Q Q \\ \frac{dE}{dt} &= (\tau - \lambda E) + S\beta \left(\frac{I_P + b_C I_C + b_A I_A}{N} \right) - \delta_E E \\ \frac{dI_P}{dt} &= -(\lambda I_P) + r\delta_E E - \delta_P I_P + \pi_{I_P} \delta_Q Q \\ \frac{dI_C}{dt} &= -(\lambda I_C) + \delta_P I_P - \delta_C I_C \\ \frac{dI_A}{dt} &= -(\lambda I_A) + (1 - r)\delta_E E - \delta_A I_A + \pi_{I_A} \delta_Q Q \\ \frac{dR_S}{dt} &= \lambda(I_P + I_C - rE) + \delta_C I_C \\ \frac{dR_A}{dt} &= \lambda(I_A - (1 - r)E) + \delta_A I_A + \pi_{R_A} \delta_Q Q \\ \frac{dQ}{dt} &= S\beta \left(\frac{\phi Q}{N} \right) - \delta_Q Q\end{aligned}\tag{1}$$

2 Parameters

Parameters have similar meaning to that of Miller model with a few additions as follows

- π_i : probability of entering ith compartment given that you are leaving Q. In this model, $\pi_S + \pi_I P + \pi_I A + \pi_R A = 1$
- ϕ : rate of contact tracing