COVID-19 Model Containing Contact Tracing and Quarantine

1 Model Equations

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\begin{aligned}
S_{j+1} &= S_j - S_j \alpha c \left(\frac{I_P + b_c I_C + b_a I_A}{N} \right) - (r\delta_E E_{j-4}) q(1-\alpha) c (b_c(S_j + S_{j-1}) + (S_{j-2} + S_{j-3})) \frac{1}{N} && (1)\\
E_{j+1} &= E_j - S_j \alpha c \left(\frac{I_P + b_c I_C + b_a I_A}{N} \right) - (r\delta_E E_{j-4}) q\alpha c (b_c(S_j + S_{j-1}) + (S_{j-2} + S_{j-3})) \frac{1}{N} - \delta_E E_j && (2)\\
I_{P_{j+1}} &= I_{Pj} + r\delta_E E_j - \delta_{I_P} I_{Pj} && (3)\\
I_{C_{j+1}} &= I_{Cj} + \delta_{I_P} I_{Pj} + \delta_Q Q_j - \delta_{I_C} I_{Cj} && (4)\\
I_{A_{j+1}} &= I_{Aj} + (1-r)\delta_E E_j - \delta_{I_A} I_{Aj} && (5)\\
Q_{j+1} &= Q_j + (r\delta_E E_{j-4}) cq\alpha r (b_c(S_j + S_{j-1}) + (S_{j-2} + S_{j-3})) \frac{1}{N} - \delta_Q Q_j && (6)\\
Q_{A_{j+1}} &= Q_{A_j} + (r\delta_E E_{j-4}) cq\alpha (1-r) (b_c(S_j + S_{j-1}) + (S_{j-2} + S_{j-3})) \frac{1}{N} - \delta_{Q_A} Q_{A_j} && (7)\\
S_{Q_{j+1}} &= S_{Q_j} + (r\delta_E E_{j-4}) q(1-\alpha) c (b_c(S_j + S_{j-1}) + (S_{j-2} + S_{j-3})) \frac{1}{N} - \delta_{S_Q} S_{Q_j} && (8)\\
R_{j+1} &= R_j + \delta_{I_C} I_{C_j} + \delta_{I_A} I_{A_j} + \delta_{Q_A} Q_{A_j} && (9)
\end{aligned}
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2 Parameters

- c : Contact rate between an infectious individual and susceptible individuals
- α: Probability of transmission given a contact
- τ : Days for covid-19 test results
- r: Probability that an exposed individual becomes presymptomatic and move to I_P
- q: Contact tracing effectiveness rate
- b_A : Decrease in asymptomatic infectivity
- b_C: Decrease in clinical infectivity
- δ_E: Mean time spent in Exposed
- δ_{I_P}: Mean time spent in Infected Pre-Clinical
- δ_{I_C}: Mean time spent in Infected Clinical

- δ_{I_A}: Mean time spent in Infected asymptomatic
- δ_Q: Mean time spent in Q (Quarantine)
- δ_{Q_A}: Mean time spent in Q_A
- δ_{S_Q}: Mean time spent in S_Q