COVID-19 Model Containing Contact Tracing and Quarantine

1 Model Equations

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\begin{aligned}
\frac{dS}{dt} &= -S\beta\left(\frac{I_P + b_C I_C + b_A I_A}{N}\right) - \lambda S + \delta_{Q_S} Q_S \\
\frac{dE}{dt} &= S\beta\left(\frac{I_P + b_C I_C + b_A I_A}{N}\right) - \lambda E - \delta_E E \\
\frac{dI_P}{dt} &= r\delta_E E - \delta_{I_P} I_P \\
\frac{dI_C}{dt} &= \delta_{I_P} I_P - \delta_{I_C} I_C \\
\frac{dI_A}{dt} &= (1-r)\delta_E E - \lambda I_A - \delta_{I_A} I_A \\
\frac{dR_S}{dt} &= \delta_{I_C} I_C + \delta_{Q_{R_S}} Q_{R_S} \\
\frac{dR_A}{dt} &= \delta_{I_A} I_A - \lambda R_A + \delta_{Q_{RA}} Q_{R_A} \\
\frac{dQ_S}{dt} &= \lambda S - \delta_{Q_S} Q_S \\
\frac{dQ_E}{dt} &= \lambda E - \delta_E Q_E \\
\frac{dQ_{I_P}}{dt} &= r\delta_E Q_E - \delta_{I_P} Q_{I_P} \\
\frac{dQ_{I_C}}{dt} &= \delta_{I_P} Q_{I_P} - \delta_{I_C} Q_{I_C} \\
\frac{dQ_{I_A}}{dt} &= \lambda I_A + (1-r)\delta_E Q_E - \delta_{I_A} Q_{I_A} \\
\frac{dQ_{R_S}}{dt} &= \delta_{I_C} Q_{I_C} - \delta_{Q_{R_S}} Q_{R_S} \\
\frac{dQ_{R_A}}{dt} &= \lambda R_A - \delta_{Q_{R_A}} Q_{R_A} + \delta_{I_A} Q_{I_A}
\end{aligned}
\tag{1}
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2 Parameters

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