

equations

group 2

2024-05-01

CONTACT RATES

$$c_{f,internal} = \frac{c_{m,internal} \cdot m_{num}}{f_{num}}$$
$$c_{f,external} = c_{m,external}$$

FORCE OF INFECTION

UNVACCINATED

$$\lambda_{uv,g,external} = \tau c_{g,external} I_{g*,external}$$
$$\lambda_{uv,g,internal} = \tau c_{g,internal} \frac{i_{num,g*}}{n_{g*}}$$
$$\lambda_{uv,g} = \lambda_{uv,g,external} + \lambda_{uv,g,internal}$$

VACCINATED

$$\lambda_{v,g,external} = \tau(1 - \psi) c_{g,external} I_{g*,external}$$
$$\lambda_{v,g,internal} = \tau(1 - \psi) c_{g,internal} \frac{i_{num,g*}}{n_{g*}}$$
$$\lambda_{v,g} = \lambda_{v,g,external} + \lambda_{v,g,internal}$$

Susceptible Unexposed (For individuals aged 11-18 years):

$$\begin{aligned}
\frac{dU_{uv,g}}{dt} &= 0.5(1 - \omega_g \chi) \nu N - \alpha_{\text{in}} U_g - \mu_u U_{uv,g} \\
\frac{dS_g}{dt} &= \alpha_{\text{in}} U_g - \mu_e S_g - \alpha_{\text{out}} S_g - \lambda_{uv,g} Z S_g - \lambda_{uv,g} (1 - Z) S_g + \delta_{uv,a} I_{uv,g,a} + \delta_{uv,s} I_{uv,g,s} - \kappa S_g \\
\frac{dI_{uv,g,a}}{dt} &= -\alpha_{\text{out}} I_{uv,g,a} - \mu_e I_{uv,g,a} + \lambda_{uv,g} (1 - Z) S_g - \delta_{g,a} I_{uv,g,a} \\
\frac{dI_{uv,g,s}}{dt} &= -\alpha_{\text{out}} I_{uv,g,s} - \mu_e I_{uv,g,s} + \lambda_{g,s} Z S_g - \delta_{uv,s} I_{uv,g,s}
\end{aligned}$$

VACCINATED

$$\begin{aligned}
\frac{dU_{v,g}}{dt} &= 0.5\omega_g \chi \nu N - \alpha_{\text{in}} V_g - \mu_u U_{v,g} \\
\frac{dV_g}{dt} &= \alpha_{\text{in}} U_{v,g} - \alpha_{\text{out}} V_g - \mu_e V_g - \lambda_{v,g} Z V_g - \lambda_{v,g} (1 - Z) V_g + \delta_{v,a} I_{v,g,a} + \delta_{v,s} I_{v,g,s} + \kappa S_g \\
\frac{dI_{v,g,a}}{dt} &= -\alpha_{\text{out}} I_{v,g,a} - \mu_e I_{v,g,a} + \lambda_{v,g} (1 - Z) V_g - \delta_{v,a} I_{v,g,a} \\
\frac{dI_{v,g,s}}{dt} &= -\alpha_{\text{out}} I_{v,g,s} - \mu_e I_{v,g,s} + \lambda_{v,s} Z V_g - \delta_{v,s} I_{v,g,s}
\end{aligned}$$