equations

group 2

2024-04-27

CONTACT RATES

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

FORCE OF INFECTION

UNVACCINATED

$$\lambda_{uv,g,external} = \tau \cdot c_{g,external} \cdot I_{g*,external}$$

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

$$\lambda_{uv,g} = \lambda_{uv,g,external} + \lambda_{uv,g,internal}$$

VACCINATED

$$\lambda_{v,g,external} = \tau \cdot (1 - \psi) \cdot c_{g,external} \cdot I_{g*,external}$$

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

$$\lambda_{v,g} = \lambda_{v,g,external} + \lambda_{v,g,internal}$$

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

$$\frac{dU_{uv,g}}{dt} = 0.5(1 - \omega_g\chi)\nu N - \alpha_{\text{in}}U_g - \mu_u U_{uv,g}$$

Susceptible Exposed

For sexually active individuals:

$$\frac{dS_g}{dt} = \alpha_{\text{in}} U_g - \mu_e S_g - \alpha_{\text{out}} S_g - \lambda_{uv,g} Z S_g - \lambda_{uv,g}(1-Z) S_g + \delta_{uv,a} I_{uv,g,a} + \delta_{uv,s} I_{uv,g,s} - \kappa S_g$$

Infected Asymptomatic

$$\frac{dI_{uv,g,a}}{dt} = -\alpha_{\text{out}} I_{uv,g,a} - \mu_e I_{uv,g,a} + \lambda_{uv,g}(1-Z) S_g - \delta_{g,a} I_{uv,g,a}$$

Infected Symptomatic

$$\frac{dI_{uv,g,s}}{dt} = -\alpha_{\text{out}} I_{uv,g,s} - \mu_e I_{uv,g,s} + \lambda_{g,s} Z S_g - \delta_{uv,s} I_{uv,g,s}$$

VACCINATED

$$\frac{dU_{v,g}}{dt} = 0.5 \omega_g \chi \nu N - \alpha_{\text{in}} V_g - \mu_u U_{v,g}$$

Vaccinated Exposed/Sexually Active

$$\frac{dV_g}{dt} = \alpha_{\text{in}} U_{v,g} - \alpha_{\text{out}} V_g - \mu_e V_g - \lambda_{v,g} Z V_g - \lambda_{v,g}(1-Z) V_g + \delta_{v,a} I_{v,g,a} + \delta_{v,s} I_{v,g,s} + \kappa S_g$$

Infected Asymptomatic (Vaccinated)

$$\frac{dI_{v,g,a}}{dt} = -\alpha_{\text{out}} I_{v,g,a} - \mu_e I_{v,g,a} + \lambda_{v,g}(1-Z) V_g - \delta_{v,a} I_{v,g,a}$$

Infected Symptomatic (Vaccinated)

$$\frac{dI_{v,g,s}}{dt} = -\alpha_{\text{out}} I_{v,g,s} - \mu_e I_{v,g,s} + \lambda_{v,s} Z V_g - \delta_{v,s} I_{v,g,s}$$