

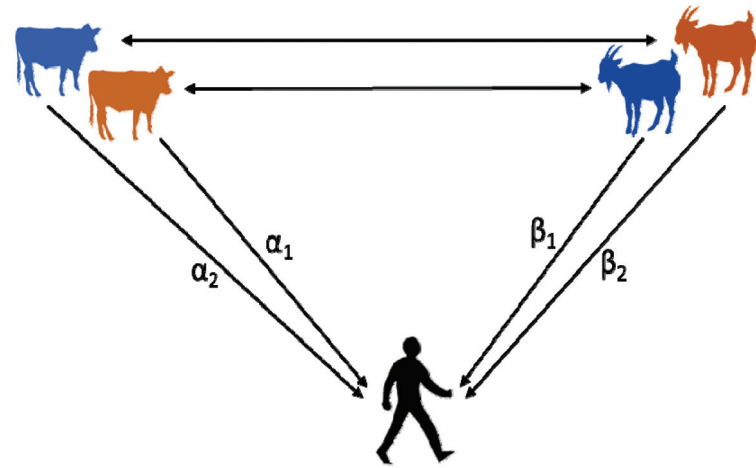
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Mathematical modelling of infectious diseases

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$$\begin{aligned}
 &= aN - bS - \beta_v SI - \alpha_w M_s S; & N &= S + I + R \\
 &= \beta_v SI - I(b + \alpha_v + \sigma) - \alpha_w M_i I; & \Gamma &= \mu + \alpha_w \\
 &= I\sigma - bR - \alpha_w M_r R; & \Gamma_E &= b + \alpha_v + \sigma + \alpha_w M_i \\
 \frac{dM_s}{dt} &= \frac{\beta_p (\lambda_s M_s S + \lambda_i M_i I + \lambda_r M_r R) - M_s (\Gamma + \frac{\alpha N}{S}) - \frac{M_s^2 \alpha_w}{k}}{\gamma + \beta_p N} \\
 \frac{dM_i}{dt} &= \frac{\beta_p (\lambda_s M_s S + \lambda_i M_i I + \lambda_r M_r R) + S \beta_v (M_s - M_i) - M_i \Gamma - M_i^2 \alpha_w}{\gamma + \beta_p N} \\
 \frac{dI}{dt} &= \frac{\beta_p (\lambda_s M_s S + \lambda_i M_i I + \lambda_r M_r R) + \frac{I\sigma}{R} (M_i - M_r) - M_i \Gamma - I^2 \alpha_w}{\gamma + \beta_p N} \\
 T_k &= \frac{\beta_v I^* \sigma}{\Omega \Gamma_E (b + \alpha_w M_i)} \\
 \phi &= T_s \beta_s + T_i \beta_i
 \end{aligned}$$



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