Mode 1 (on-treatment)

$\text{flow}_1:$

$$\frac{dx}{dt} = \left(\alpha_x \left(\frac{1}{1+e^{-(z-k_1)k_2}} \right) - \beta_x \left(\frac{1}{1+e^{-(z-k_3)k_4}} \right) - m_1 \left(1 - \frac{z}{z_0} \right) - \lambda_x \right) x + \mu_x$$

$$\frac{dy}{dt} = m_1 \left(1 - \frac{z}{z_0} \right) x + \left(\alpha_y \left(1 - d \frac{z}{z_0} \right) - \beta_y \right) y$$

$$\frac{dz}{dt} = \frac{-z}{\tau} + \mu_z$$

$$\frac{dv}{dt} = \left(\alpha_x \left(\frac{1}{1+e^{-(z-k_1)k_2}} \right) - \beta_x \left(\frac{1}{1+e^{-(z-k_3)k_4}} \right) - m_1 \left(1 - \frac{z}{z_0} \right) - \lambda_x \right) x + \mu_x$$

$$+ m_1 \left(1 - \frac{z}{z_0} \right) x + \left(\alpha_y \left(1 - d \frac{z}{z_0} \right) - \beta_y \right) y$$

$\text{jump}_{1 \to 2}:$

$$x + y \le r_0 \wedge \frac{dx}{dt} + \frac{dy}{dt} < 0 \vee w \ge t_{\max}$$

$\text{jump}_{2 \to 1}:$

$$x + y \ge r_1 \wedge \frac{dx}{dt} + \frac{dy}{dt} > 0$$

Mode 2 (off-treatment)

$\text{flow}_2:$

$$\frac{dx}{dt} = \left(\alpha_x \left(\frac{1}{1+e^{-(z-k_1)k_2}} \right) - \beta_x \left(\frac{1}{1+e^{-(z-k_3)k_4}} \right) - m_1 \left(1 - \frac{z}{z_0} \right) - \lambda_x \right) x + \mu_x$$

$$\frac{dy}{dt} = m_1 \left(1 - \frac{z}{z_0} \right) x + \left(\alpha_y \left(1 - d \frac{z}{z_0} \right) - \beta_y \right) y$$

$$\frac{dz}{dt} = \frac{z_0 - z}{\tau} + \mu_z$$

$$\frac{dv}{dt} = \left(\alpha_x \left(\frac{1}{1+e^{-(z-k_1)k_2}} \right) - \beta_x \left(\frac{1}{1+e^{-(z-k_3)k_4}} \right) - m_1 \left(1 - \frac{z}{z_0} \right) - \lambda_x \right) x + \mu_x$$

$$+ m_1 \left(1 - \frac{z}{z_0} \right) x + \left(\alpha_y \left(1 - d \frac{z}{z_0} \right) - \beta_y \right) y$$