Mode 1 (on-treatment)

$\text{flow}_1:$

$$\frac{dx}{dt} = f_1 = \left(\alpha_x\left(\frac{1}{1+e^{-(z-k_1)k_2}}\right) - \beta_x\left(\frac{1}{1+e^{-(z-k_3)k_4}}\right) - m_1\left(1-\frac{z}{z_0}\right) - \lambda_x\right)x + \mu_x$$

$$\frac{dy}{dt} = f_2 = m_1\left(1-\frac{z}{z_0}\right)x + \left(\alpha_y\left(1-d\frac{z}{z_0}\right) - \beta_y\right)y$$

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

$$\frac{dv}{dt} = f_3 = \left(\alpha_x\left(\frac{1}{1+e^{-(z-k_1)k_2}}\right) - \beta_x\left(\frac{1}{1+e^{-(z-k_3)k_4}}\right) - m_1\left(1-\frac{z}{z_0}\right) - \lambda_x\right)x + \mu_x$$

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

$\text{jump}_{1\to2}:$

$$x + y \le r_0 \wedge \frac{dx}{dt} + \frac{dy}{dt} < 0$$

$$\vee\, w \ge t_{\max}$$

$\text{jump}_{2\to1}:$

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

$\text{jump}_{1\to3}:$

$$v = \frac{v(0)}{2}$$

Mode 2 (off-treatment)

$\text{flow}_2:$

$$\frac{dx}{dt} = f_1$$

$$\frac{dy}{dt} = f_2$$

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

$$\frac{dv}{dt} = f_3$$

Mode 3 (dummy)