Mode 1 (on-treatment)

$\mathrm{flow}_1:$

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

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

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

$$\frac{dv}{dt} = \left(\alpha_x\left(k_1 + \frac{(1-k_1)z}{z+k_2}\right) - \beta_x\left(k_3 + \frac{(1-k_3)z}{z+k_4}\right) - m_1\left(1-\frac{z}{z_0}\right)\right)x$$
$$+ m_1\left(1-\frac{z}{z_0}\right)x + \left(\alpha_y\left(1-d\,\frac{z}{z_0}\right) - \beta_y\right)y$$

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

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

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

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

Mode 2 (off-treatment)

$\mathrm{flow}_2:$

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

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

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

$$\frac{dv}{dt} = \left(\alpha_x\left(k_1 + \frac{(1-k_1)z}{z+k_2}\right) - \beta_x\left(k_3 + \frac{(1-k_3)z}{z+k_4}\right) - m_1\left(1-\frac{z}{z_0}\right)\right)x$$
$$+ m_1\left(1-\frac{z}{z_0}\right)x + \left(\alpha_y\left(1-d\,\frac{z}{z_0}\right) - \beta_y\right)y$$