Surveillance simulation equations

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\begin{aligned}
S_{t+1} - S_t &= -S_t\lambda && (1)\\
E_{t+1} - E_t &= S_t\lambda - mE_t && (2)\\
I_{At+1} - I_{At} &= \alpha mE_t - (\psi_A + \gamma_A)I_{At} && (3)\\
A_{At+1} - A_{At} &= \psi_A I_{At} - \gamma_A A_{At} && (4)\\
I_{Pt+1} - I_{Pt} &= (1-\alpha)mE_t - (\sigma_P + \psi_P)I_{Pt} && (5)\\
A_{Pt+1} - A_{Pt} &= \psi_P I_{Pt} - \sigma_P A_{Pt} && (6)\\
I_{Mt+1} - I_{Mt} &= \sigma_P I_{Pt} - (\sigma_M + \psi_M + \gamma_M)I_{Mt} && (7)\\
A_{Mt+1} - A_{Mt} &= \sigma_P A_{Pt} + \psi_M I_{Mt} - (\sigma_M + \gamma_M)A_{Mt} && (8)\\
I_{Ct+1} - I_{Ct} &= \sigma_M I_{Mt} - (\gamma_C + \psi_C + \mu_C)I_{Ct} && (9)\\
A_{Ct+1} - A_{Ct} &= \psi_C I_{Ct} + \sigma_M A_{Mt} - (\gamma_C + \mu_C)A_{Ct} && (10)\\
R_{t+1} - R_t &= \gamma_A I_{At} + \gamma_M I_{Mt} + \gamma_C I_{Ct} && (11)\\
R_{At+1} - R_{At} &= \gamma_A A_{At} + \gamma_M A_{Mt} + \gamma_C A_{Ct} && (12)\\
D_{t+1} - D_t &= \mu_C I_{Ct} && (13)\\
D_{At+1} - D_{At} &= \mu_C A_{Ct} && (14)
\end{aligned}
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$$\lambda = \beta\frac{(I_A + I_P + I_M + I_C) + r(A_A + A_P + A_M + A_C)}{N} \quad (15)$$

$$\sigma = \text{Progression rates between infectious compartments} \quad (16)$$

$$\gamma = \text{Recovery rates} \quad (17)$$

$$\psi = \text{Ascertainment rates} \quad (18)$$

$$\mu = \text{Death rates} \quad (19)$$

$$(20)$$