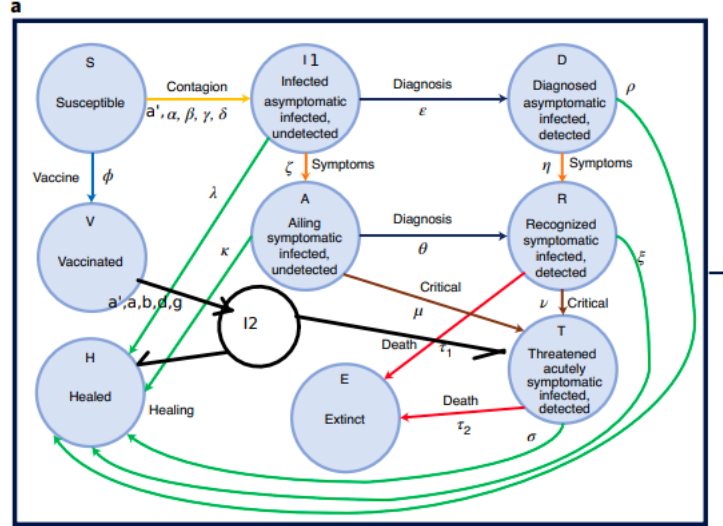


# *SIDARTHE* – VI: The *SIDARTHE* with infectious vaccinated mathematical model

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Contrary to the *SIDARTHE* – V model which is based in the assumption that all vaccinated are immunized, *SIDARTHE* – VI model assumes that vaccinated, in the V compartment, can still get infected and become infectious just like for non-vaccinated susceptible, in the S compartment. It is observed that a few portion of the vaccinated but infected, in the I<sub>2</sub> compartment, are threatened by the disease. The new model captures this dynamics by connecting the I<sub>2</sub> compartment to the T compartment. This results into the diagram below



The addition of these new connections have changed the partial differential equations of the *SIDARTHE* model to the following

$$\dot{S} = -(\alpha I + \beta D + \gamma A + \delta R) S - \phi S \quad (1)$$

$$\dot{V} = -(\alpha I + \beta D + \gamma A + \delta R) V + \phi S \quad (2)$$

$$\dot{I} = (\alpha I + \beta D + \gamma A + \delta R) (S + V) - (\epsilon + \lambda + \zeta) I \quad (3)$$

$$\dot{D} = \epsilon I - (\eta + \rho) D \quad (4)$$

$$\dot{A} = \zeta I - (\theta + \mu + \kappa) A \quad (5)$$

$$\dot{R} = \eta D + \theta A - (\tau_1 + \nu) R \quad (6)$$

$$\dot{T} = \mu A + \nu R - (\tau_2 + \sigma) T \quad (7)$$

$$\dot{H} = \lambda I + \kappa A + \sigma T + \xi R + \rho D \quad (8)$$

$$\dot{E} = \tau_1 R + \tau_2 T \quad (9)$$

The reproduction number is given by

$$R_0 = \frac{s(\alpha r_2 r_3 r_4 + \beta \epsilon r_3 r_4 + \delta \epsilon \eta r_3 + \delta r_2 \tau \zeta + \gamma r_2 r_4 \zeta)}{r_1 r_2 r_3 r_4} \quad (10)$$

$$= \frac{s(\alpha r_2 r_3 r_4 + \beta \epsilon r_3 r_4 + \delta \epsilon \eta r_3 + \delta r_2 \tau \zeta + \gamma r_2 r_4 \zeta)}{r_1 r_2 r_3 r_4} \quad (11)$$