A Mathematical Model of STDs in Campus

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March 30, 2024

0.1 Assumption of the model

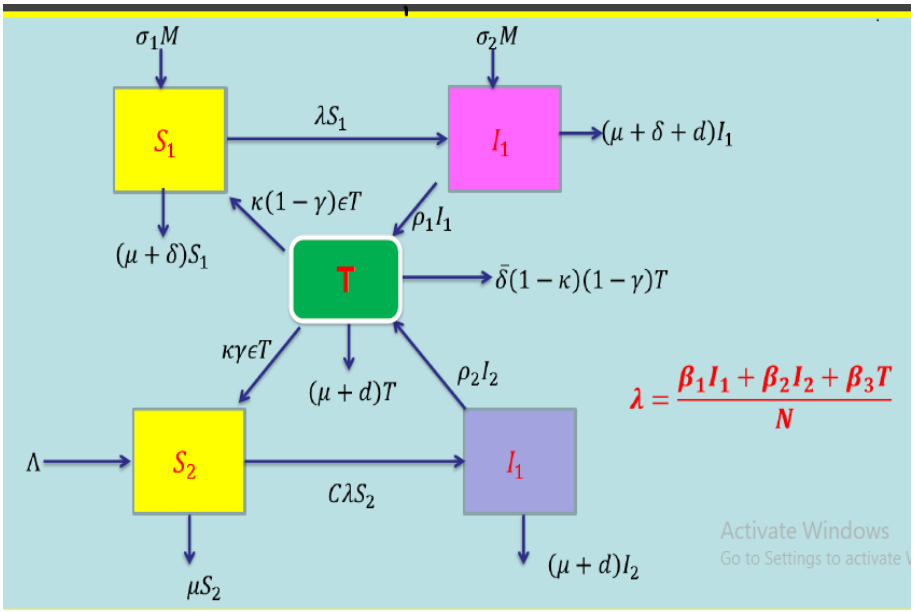
- We assumed the total population(N) subdivided into five compartments.
- The state variables are the form $(S_1, I_1, S_2, I_2, T) \in R^5$ with:
  - S_1 ... Susceptible individuals in the university community.
  - I_1 ... Infected individuals in the university community.
  - S_2 ... Susceptible individuals in the university Surrounding .
  - I_2... Infected individuals in the surrounding Population.
  - T ... The number of individuals treated with STD in the health centers
- The main parametric assumption in our Model:-
  - κ be the proportion effective treatment program from STD(efficacy level) join the active susceptible compartments and the remaining proportion $1 - \kappa$ inefficient of the treatment program.
  - γ be the proportion of awareness level of STD join the active susceptible compartment S_2 and the remaining proportion $1 - \gamma$ awareness level of STD from the disease join in to active susceptible individual in campus.
  - β_1 , β_2 and β_3 are transmission rate of the disease to an active susceptible (S_1 and S_2 individuals) from I_1, I_2 and T

0.2 Parameter description

Table 1: **Parameter values and their description**

Parameters	Description	Value(/year)	Sources
Λ	Recruitment rate		
γ	The proportion of awareness level of STD join to the active susceptible		
κ	The proportion of effective treatment from STD(efficacy level)		
ϵ	Rate of being put on treatment		
M	Recruitment of university students		
μ	The natural death rate		
d	Diseases related death rate		
ρ_1	The rate of infected person join the health center from campus		
ρ_2	The rate of infected person join the health center from surrounding		
σ_1	Recruitment rate of freshman students to S_1		
σ_2	Recruitment rate of freshman students to I_1		
β_1	Transmission rate per act in $I_1(t)$ class		
β_2	Transmission rate per act in $I_2(t)$ class		
β_3	Transmission rate per act in $T(t)$ class		
δ	The student graduation rate		
δ	The student graduation rate under treatment center		
c	Average number of unsafe sexual acts		

0.3 Flow Chart of the dynamical system



0.4 Dynamical System

$$\begin{cases} \frac{dS_1}{dt} &= \sigma_1 M + \kappa(1-\gamma)\epsilon T - (\lambda+\mu+\delta)S_1 \\ \frac{dI_1}{dt} &= \sigma_2 M + \lambda S_1 - (\rho_1+\mu+d+\delta)I_1 \\ \frac{dS_2}{dt} &= \Lambda + \kappa\gamma\epsilon T - (c\lambda+\mu)S_2 \\ \frac{dI_2}{dt} &= c\lambda S_2 - (\rho_2+\mu+d)I_2 \\ \frac{dT}{dt} &= \rho_1 I_1 + \rho_2 I_2 - [\kappa\epsilon + \bar{\delta}(1-\kappa)(1-\gamma)\epsilon + \mu + d)]T \end{cases} \quad (1)$$

with initial conditions: $S_1(0) = S_1^0$, $S_2(0) = S_2^0$, $I_1(0) = I_1^0$, $I_2(0) = I_2^0$ and $T(0) = T^0$.