Poster-#(poster number, leave blank):

Social response could cause recurring epidemic outbreaks: A mathematical model

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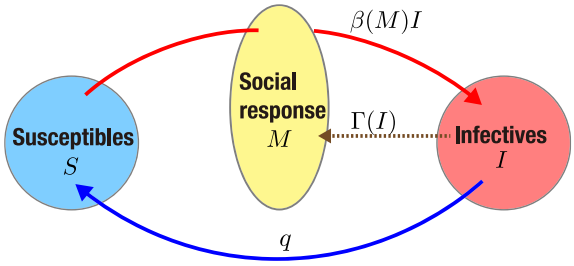
Recurring epidemic outbreaks have been observed for different kinds of infectious diseases and places. Such an epidemic recurrence could affect the policy making, hinder the economy, consume medical resources, and break people's confidence in fighting the disease. When a transmissible disease invades, the community may respond to the disease in such a way as wearing masks to reduce the infection risk or by getting the vaccine to prevent the serious symptoms and the disease transmission. In contrast, the community may be insensitive to the disease. In this work, we consider the following Susceptible-Infective-Susceptible (SIS) model, taking into account the effect of such the social response:



$$\frac{dS}{dt} = -\beta(M)SI - qI$$

$$\frac{dI}{dt} = \beta(M)SI - qI$$

$$\frac{dM}{dt} = \Gamma(I) - \mu M,$$

where $S(t)$ and $I(t)$ are the susceptible and infective population densities in the community at time t, while $M = M(t)$ is the strength of the social response at time t. q is the recovery rate and μ is the natural decay rate of the social response. The coefficient of disease transmission $\beta = \beta(M)$ is given by a continuous and decreasing function of M. We assume the initial condition as $S(0) > 0$, $I(0) > 0$, and $M(0) = 0$, which means that there is no social response at the beginning of the disease spread. At the initial state, people know little information and are unconcern about the disease spread. The social sensitivity function $\Gamma(I)$ represents the nature of the social response according to its sensitivity to the disease spread. We assume that the social response does not arise as long as the infective population density I is not beyond the threshold value I_c:

$$\Gamma(I) := \begin{cases} 0 & \text{for } I \le I_c; \\ \gamma(I - I_c) & \text{for } I > I_c. \end{cases}$$

The threshold value I_c can be regarded as representing the social insensitivity to characterize the community. Positive parameter γ is the social sensitivity coefficient which characterizes the responsiveness of the community to the epidemic situation in the community.

In this presentation, we will show the results on the possible contribution of the social sensitivity and insensitivity to the occurrence of an oscillatory variation in the epidemic dynamics, which could be observed as recurring outbreaks.