SIR model with the distribution of preventive behaviors in a community

*Zhiqiong Fu¹, Hiromi Seno¹ (1. Tohoku University (Japan))

Keywords : Epidemics, Population dynamics model, Social structure

In this work, we consider a mathematical model of differential equations for the epidemic dynamics with a distribution of preventive behaviors among individuals, focusing on how the distribution of preventive behaviors influences the epidemic consequence in a community. The preventive behavior determines the level of caution to the disease transmission. We assume that the community could be categorized into *n* classes based on their caution level about a spreading disease in it. The caution level is reflected to not only the susceptibility to the spreading disease but also its transmissibility to others in the community. Susceptible individuals of low caution level are more likely to get infected than those of high caution level. Infected individuals of low caution level contribute more to the disease transmission than those of high caution level. We begin with an SIR-type model that incorporates such a social structure with n classes of different caution levels. The total population is constant, as demographic changes due to birth, death or migration are assumed to be negligible during the epidemic season. Further, the size of each class is assumed to be fixed throughout the epidemic season. We principally investigate how the size distribution of classes could affect the final epidemic size in a community, which is defined as the population size of individuals who experienced the disease transmission, and discuss how significantly the outbreak of disease spread depends on the nature of the distribution.