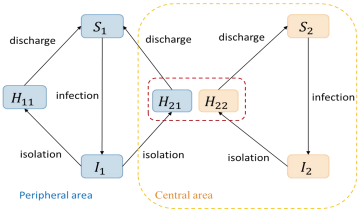
A Mathematical Consideration for the Effect of Regional Lockdown on Endemic Size



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Keywords: Epidemic dynamics, Mathematical model, Ordinary differential equations, Lockdown, Endemic size

To balance the epidemic control and social activities, the policymaker needs to choose a better policy to take account of a balance of them. In this work, making use of a system of ordinary differential equations, we construct a mathematical model of epidemic dynamics in a community composed of the peripheral area and central area which respectively have different qualities about the medical treatment for the disease. We introduce different restrictions on the mobility of individuals and define four types of lockdowns: complete lockdown, strong lockdown, weak lockdown type 1, and weak lockdown type 2. Then we compare the efficiencies of those lockdowns according to the endemic size, that is, the number of infected individuals at the endemic equilibrium. Mathematical results obtained by the analysis on our model imply that the complete and strong lockdowns result in no difference with respect to the endemic size, while it necessarily becomes smaller than that by the weak lockdown. However, since such lockdowns with a strong restriction must be costly, it must be worth discussing the properness of weak lockdowns as a feasible policy for the public health.