

Coupled SIS Models

A possible control mechanism during an epidemic is quarantining infected individuals. In this project, you will develop a SIS-type model with an additional quarantined group. How does a quarantine program affect the epidemic? Could it prevent the infection from becoming an epidemic and/or an endemic infection?

Some Model Requirements

- The model without quarantine is a SIS-type model, which is similar to an SIR-type model except that there is no immunity.
- A SIS model the population into two groups: Susceptible (S) and Infected (I). There is no recovered group so recovered infected members become susceptible again.
- Susceptible members are infected, becoming a member of the Infected population, at a rate proportional to their population size and the size of the Infected population.
- Infected members recover to become Susceptible members at a rate proportional to the size of the Infected population.
- When quarantine is introduced, a third group is required Quarantined (Q).
- Quarantine works by removing a member from the Infected group into the Quarantined group, where they are now unable to infect members of the Susceptible group.
- Quarantined members recover to become susceptible again at the same rate as a member of the Infected group would.

Some Questions to Answer

- What are the dynamics of SIS-type model without quarantine? Under what conditions would the infection be endemic?
- How does quarantine affect the dynamics of the infection? Can it make an endemic infection go away? Can it prevent an outbreak?
- What is the minimum rate at which Infected members are quarantined for the quarantine program to be effective at stopping the outbreak?