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An Age-dependent Population Model with Contact Tracing in Epidemic Diseases

Conatct tracing is an important method that has been used in the control of endemic contagious disease for decades, but we do not know much about the effectiveness or even the necessity of contact tracing yet. Contact tracing, followed by isolation, can reduce an additional number of infected individuals who are not removed by isolation process. That is the reason contact tracing is considered to be a useful method for reducing infections. Most of us believe that if some is good then more is better. So people intuitively deduce that high level contact tracing (those trace more contacts or last for longer period of time) results in having less infections than relatively low level contact tracing does. But that argument is not always the case according to our model.

We build a deterministic SIR model with isolation and contact tracing in the control of an epidemic disease. The model is applicable to diseases like smallpox, H1N1, SARS and some modern influenzas. We are able to conclude that tracing too many contacts during the contact tracing period might just postpone the outbreak of the disease and might NOT reduce infections effectively. Of course, it does not mean that we have the same kind of results for all infectious diseases and contact tracing strategies. There is a subtle connection between the apparence of the special case and the nature of the epidemic disease.

I will be interested in presenting some background of contact tracing, introducing the main model, demonstrating simulation results of different cases, explaining mathematically why the special cases appear and providing suggestions about how to choose a suitable contact tracing level. I'm also looking forward to knowing how well the model together with the conclusion and explanation can be understood by researchers from related areas, and any suggestions about either model improvement or future study will be appreciated very much.