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Controlling epidemic spread by responding to risk: Do it well or not at all

Disease outbreaks change people behaviour. This change can be used to control epidemics but it comes at a cost. We describe results from using simulation to study the costs and benefits of using social distancing as a form of control. Our model consists of a standard SIR model superimposed on a simple spatial network. Disease spread is controlled by allowing susceptible individuals to temporarily reduce their social contacts in response to the presence of infection within their local neighbourhood. We ascribe an economic cost to the loss of social contacts, and weigh this against the economic benefit gained by reducing the attack rate of the epidemic. Our first result is that, depending on the characteristics of the epidemic and on the relative economic importance of making contacts versus avoiding infection, the optimal control is one of two extremes: either to *panic*, that is, to adopt a highly cautious control, thereby suppressing the epidemic quickly by drastically reducing contacts as soon as disease is detected; or else to *relax* by forgoing control and allowing the epidemic to run its course. The worst outcome arises when control is attempted, but not cautiously enough to cause the epidemic to be suppressed. Our second result comes from comparing the size of the neighbourhood of which individuals are aware to that of the neighbourhood within which transmission can occur. We see that control works best when these sizes match, and that it is particularly ineffective when the awareness neighbourhood is smaller than the infection neighbourhood. These results have implications for the design of control strategies using social distancing. An important message is that a weak control, or one based upon inaccurate knowledge, may give a worse outcome than doing nothing.

References

[1] A. Author, *Title of paper* Journal Name **1** 1–10.