



Individual preventive social distancing during an epidemic may have negative population-level outcomes

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Abstract

The outbreak of an infectious disease in a human population can lead to individuals responding with preventive measures in an attempt to avoid getting infected. This leads to changes in contact patterns. However, as we show in this paper, rational behaviour at the individual level, such as social distancing from infectious contacts, may not always be beneficial for the population as a whole. We use epidemic network models to demonstrate the potential negative consequences at the population level. We take into account the social structure of the population through several network models. As the epidemic evolves, susceptible individuals may distance themselves from their infectious contacts. Some individuals replace their lost social connections by seeking new ties. If social distancing occurs at high rates at the beginning of an epidemic, then this can prevent an outbreak from occurring. However, we show that moderate social distancing can worsen the disease outcome both in the initial phase of an outbreak and the final epidemic size. Moreover, the same negative effect can arise in real-world networks. Our results suggest that one needs to be careful when targeting behavioural changes as they could potentially worsen the epidemic outcome. Furthermore, network structure crucially influences the way that individual-level measures impact the epidemic at the population level. These findings highlight the importance of careful analysis of preventive measures in epidemic models.

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