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## The Impact of Personal Experiences with Infection and Vaccination on Behaviour-Incidence Dynamics of Seasonal Influenza

Background: Personal experiences regarding past vaccination and infection events are strong predictors of future vaccine acceptance. Mathematical models can be used to capture the feedback between personal vaccine choices as influenced by personal history, and disease dynamics.

Objectives: To evaluate 1) the impact of past personal events on vaccine coverage; 2) what factors are most influential in the stability of vaccine coverage; and 3) whether vaccine opinions can become correlated in a perfectly rational network.

Methods: We coupled disease dynamics with individual vaccination decisions where personal influenza and vaccination experiences are included in the decision making process. In addition to influenza, we incorporated influenza-like-illness (ILI) into the decision-making, where a percentage of the population will mistake ILI for influenza. An individual's choice to vaccinate is influenced by their most recent experience with infection, vaccine complications and perceived vaccine efficacy. Our stochastic network model allows for further investigation into issues such as correlation of vaccine opinions on networks and factors that lead to variation in vaccination coverage from season to season. Infection is transmitted from an infectious node to a neighbouring susceptible node with some probability per day.

Results: We found that when individuals are able to recall past events for a longer period of time there, vaccine coverage becomes significantly more stable. We also noticed that as we lengthened memory, vaccine coverage increased, even though past vaccine complications would be recalled for longer as well. However, we identified a threshold where vaccination coverage started to decline after lengthening memory further. We also found that more slowly waning vaccine immunity stabilises vaccine coverage; however, there was also a decrease in coverage. The nature of close contact infection on the network, coupled with the history dependent decision-making, resulted in positively correlated vaccination strategies between neighbours, despite the absence of imitation in the model.

Conclusions: Flu vaccines conferring long-term immunity are currently in development. Our model suggests that behavioural feedbacks should be considered when developing such "universal" flu vaccines, since these can cause sporadic and unpredictable outbreaks for some of our parameter choices. Our results suggest that public health messaging should focus on reminding individuals about past infections in order to increase overall vaccine coverage and prevent unexpected drops in coverage, while at the same time reassuring the public about vaccine efficacy.