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Symmetric dynamics in models of multi-strain infections

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ABSTRACT

In mathematical studies of the dynamics of multi-strain diseases caused by antigenically diverse pathogens, there is a substantial interest in analytical insights. Using the example of a generic model of multi-strain diseases with cross-immunity between strains, I will show that a significant understanding of the stability of steady states and possible dynamical behaviours can be achieved when the symmetry of interactions between strains is taken into account [1]. Techniques of equivariant bifurcation theory allow one to identify the type of possible symmetry-breaking Hopf bifurcation, as well as to classify different periodic solutions in terms of their spatial and temporal symmetries. I will also illustrate how this framework can provide a systematic understanding of bifurcation scenarios and periodic behaviours in other models of multi-strain diseases. Besides population-levels models, I will demonstrate how the same methodology can be applied to analysis of immunological interactions between antigenic strains within a single host [2, 3]. The results of the analysis are quite generic, and I will discuss their wider implications for studying the dynamics of multi-strain diseases.

References

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