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Predicting the potential impact of a cytotoxic T-lymphocyte HIV vaccine: how often should you vaccinate and how strong should the vaccine be?

To stimulate the immune system's natural defences, a HIV vaccination program consisting of regular boosts of cytotoxic T-lymphocytes (CTLs) has been proposed. We develop a mathematical model to describe such a vaccination program, where the strength of the vaccine and the vaccination intervals are constant. We apply the theory of impulsive differential equations to show that the model has an orbitally asymptotically stable periodic orbit. We show that, on this orbit, it is possible to determine vaccine strength and vaccination intervals so that the number of infected $CD4^+$ T cells remains below a maximal threshold. We also show that the outcome is more sensitive to changes in the vaccine strength than the vaccination interval and illustrate the results with numerical simulations.