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Simulation of a dengue vaccine

Dengue is a vector-borne disease. It is nowadays endemic in more than one hundred countries, predominantly in tropical and subtropical areas. Up to the moment, the effectiveness of the programs for vector control is low and, unfortunately, there is no specific effective treatment for dengue. For recent mathematical investigations on the subject, we refer to [1, 2] and references therein.

There are no commercially available dengue clinical cures or vaccine, but efforts are underway to develop one [3]. So far, the difficulties in elaborating a vaccine stemmed from the fact that the vaccine must protect simultaneously against the four serotypes of dengue. This is a difficult but crucial constraint, because protection against only one or two dengue viruses could actually increase the risk of Dengue Haemorrhagic Fever. The population effect of a vaccination programme may be thought of as the collective impact of individual vaccination on the transmission of infection in that population. While direct individual protection is the major focus of mass vaccination programmes, population effects also contribute indirectly to individual protection through herd immunity, providing protection for unprotected individuals.

We present a SVIR-ASI epidemiological model for the human and mosquito populations, respectively. It is considered an imperfect vaccine, where a proportion of population is vaccinated. Some simulations, with different levels of vaccine efficacy, are studied. It is shown that the efficacy of the vaccine has a preponderant role in the reduction of the spread of the disease.

References

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