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Epidemiological consequences of different vaccination strategies against infectious diseases in domestic livestock

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A vaccine is a biological preparation, providing long-term protection of the host to a disease by miming the interactions between the pathogen and the immune response. For decades vaccines have been the most effective means to fight and eradicate infectious diseases, from human diseases to animals diseases, including poultry and porcine viruses. One of the most significant endemic swine disease causing major animal and economic losses all over the world is porcine reproductive and respiratory syndrome (PRRS). Although different types of vaccines are on the market and various vaccination strategies have been trialled to control the disease, PRRS continues to persist, sometimes at high prevalence. The failure of some vaccination strategies to combat the disease leaves open questions regarding the major effect that the vaccine should have, as well as the most efficient vaccination strategy. We present an SIR model of a non-vaccinated population and extend it to a model where vaccination is applied. We use numerical simulations to evaluate vaccine efficacy for different types of vaccines and vaccination strategies to predict determinants for disease prevention. The study provides important guidelines for vaccine development and application in livestock populations.

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