

Effects of seasonal birth and predation on disease spread

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For many organisms, births occur in seasonal pulses, which can affect how readily infection spreads within a population. Population changes throughout the year can also change the rate at which the organism is preyed upon, which in turn can affect disease dynamics. We use a Susceptible-Infected (SI) model to study the effects of seasonal births and predation on the spread of infection in a population. We consider models with constant and pulsed births as well as linear and hyperbolic predation functions. We calculate the basic reproductive number to determine the conditions under which infection fades out or spreads and use numerical simulations to examine system behavior when infection is able to persist. When predation depends linearly on prey populations, the timing of births does not affect average infection or disease transmissibility. However, this is not the case for systems with hyperbolic predation. Additionally, we observe that hyperbolic predation is more conducive to successful infection invasion in a population compared to linear predation.