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A stage-structured model to investigate persistence of pertussis

In this study, we construct a multi-stage age-stratified demographic model and the corresponding epidemiological model of pertussis transmission dynamics. We calculate the positive equilibrium of the demographic model. Under the assumption that the population distribution has reached this positive equilibrium, we analyze the asymptotic behavior of the disease incidence of different age groups and conclude that the disease will die out if the basic reproduction number is smaller than the unity and the infectious population distribution will converge to a unique positive equilibrium when the basic reproduction number is larger than the unity. For a specific birth function, we investigate the impact of changes of the threshold productive age and birth rate parameters on the demographic distribution and infant disease incidence rate.