Cooke, K.; **van den Driessche, P.**; **Zou, X.**

Interaction of maturation delay and nonlinear birth in population and epidemic models.

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Summary: A population with birth rate function $B(N)N$ and linear death rate for the adult stage is assumed to have a maturation delay $T > 0$. Thus the growth equation

$$N'(t) = B\big(N(t-T)\big)N(t-T)e^{-d_1 T} - dN(t)$$

governs the adult population, with the death rate in previous life stages $d_1 \geq 0$. Standard assumptions are made on $B(N)$ so that a unique equilibrium N_e exists. When $B(N)N$ is not monotone, the delay T can qualitatively change the dynamics. For some fixed values of the parameters with $d_1 > 0$, as T increases the equilibrium N_e can switch from being stable to unstable (with numerically observed periodic solutions) and then back to stable.

When disease that does not cause death is introduced into the population, a threshold parameter R_0 is identified. When $R_0 < 1$, the disease dies out; when $R_0 > 1$, the disease remains endemic, either tending to an equilibrium value or oscillating about this value. Numerical simulations indicate that oscillations can also be induced by disease related death in a model with maturation delay.

MSC:

92D30	Epidemiology
34D23	Global stability of solutions to ordinary differential equations
92D25	Population dynamics (general)
34C25	Periodic solutions to ordinary differential equations

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