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Deterministic models in mathematical epidemiology

We give a general overview of compartmental models used in mathematical epidemiology. Such models are typically formulated as a system of differential equations. We introduce the basic concepts, such as reproduction numbers and final size relations, and show how one can build the model structure based on the transmission mechanisms and other important features of a given disease and how to incorporate various intervention strategies. Advanced modeling often requires the application of infinite dimensional dynamical systems, typically due to heterogeneity (when a population is structured by age, size, spatial position or any relevant characteristics) or time delays.