An introduction to the use of mathematical models for the simulation of infectious disease.

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Abstract

The outbreak of COVID-19 has led to a surge in interest of the mathematical modeling of infectious disease. Many of the introduced models are so-called *compartmental models*, in which the total quantities characterizing a certain system may be decomposed into two (or more) species that are distributed into two (or more) homogeneous units called compartments. This short course will introduce the notion of a compartment model and the basics of their development, beginning with generalized renewal (integral) equations. We will begin with the standard SIR (susceptible-infected-recovered) model, and gradually introduce more realistic models that account for factors such as general distributions of infectious periods, waning immunity, vaccination, and more. Other relevant topics, such as agent-based models, back-calculation, Other types of modeling, such as agent-based models, will be discussed briefly, as well as other important topics, such as back-calculation and inference. Some sample python code will be provided for numerical examples. The course is open to all students; however previous exposure to differential equations and basic programming concepts is recommended.