Chapter 1
Introduction to Compartmental Models in Epidemiology

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Abstract In this chapter, we discuss the basics of compartmental models in epidemiology and requisite analysis.

Keywords Mathematical model · Dynamics · Reproduction number · Equilibrium points · Stability

Introduction

The transmission of infections is broadly classified as vector-borne, waterborne or airborne diseases in epidemiology science. The transmission of infections can be epidemic which is a sudden outbreak of a disease, e.g. COVID-19, or endemic in which disease remains in the society, e.g. malaria. Epidemics like the 2002 outbreak of SARS, the Ebola virus, Zika virus and avian flu attracted the research community to study transmission of such diseases. The outbreak of Spanish flu caused huge human life loss. An endemic situation in epidemiology is one in which disease is always prevalent.

Our objective is to discuss mathematical epidemiology, with the formulation of mathematical models for the spread of disease and criteria for their analysis. Mathematical models in epidemiology help to understand the underlying mechanism that stimulates the spread of disease progression which can be used to develop strategies to curtail the transmission of disease. The degree of heterogeneity, usually known as "threshold" or "reproduction number", helps to understand the behaviour of transmission of disease. The term "threshold" or "reproduction number" in epidemiological terms can be defined as follows: if the average number of secondary infections caused by an average infective, called the basic reproduction number, is less than one, then a

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