

Next generation matrices and the type reproduction number - beyond \mathcal{R}_0

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Abstract

There are many advantages to analysing epidemics in terms of ‘infection generations’ instead of (or as well as) chronological time. For structured populations the basic reproduction number, \mathcal{R}_0 , may be defined as the spectral radius of the next generation matrix (NGM). The construction of the NGM will be explained in two ways: by following a linear algebra recipe and by thinking about the epidemiology. Although \mathcal{R}_0 is the fundamental quantity that determines the qualitative dynamics of an infectious disease, there exist type reproduction numbers, \mathcal{T} , that give more insight into control policies and reservoirs of infection. Infection generations may overlap in chronological time, but in defining \mathcal{T} we use information from all potential future generations. Implications for the control of infectious diseases will be discussed, with a variety of examples.