A TWO-STRAIN EPIDEMIC MODEL WITH UNCERTAINTY IN THE INTERACTION

M. G. ROBERTS

(Received 30 July, 2012; revised 15 October, 2012)

Abstract

Annual epidemics of influenza A typically involve two subtypes, with a degree of cross-immunity. We present a model of an epidemic of two interacting viruses, where the degree of cross-immunity may be unknown. We treat the unknown as a second independent variable, and expand the dependent variables in orthogonal functions of this variable. The resulting set of differential equations is solved numerically. We show that if the population is initially more susceptible to one variant, if that variant invades earlier, or if it has a higher basic reproduction number than the other variant, then its dynamics are largely unaffected by cross-immunity. In contrast, the dynamics of the other variant may be considerably restricted.

Keywords and phrases: epidemics, influenza, SIR model, immunity.