

國立交通大學應用數學系

學術演講公告

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講題：Modelling the outbreak of infectious disease following mutation from a non-transmissible

時間：105 年 4 月 19 日 (星期二) 下午 2:00-3:00

地點：(光復校區) 科學一館 223 室

茶會：當天下午 1:30 (科學一館 205 室)

摘要：

A mathematical model is derived and studied to describe the outbreak of an infectious disease which is not transmissible between humans until a mutation of the virus or bacterium takes place. The feared outbreak of a transmissible form of avian influenza leading to a global epidemic is the paradigm for this study, for which we model the mutation of the virus from a bird-human to a human-human transmissible form. An extension to the SIR approach is applied, leading to a system of ordinary differential equations describing the evolution of two classes of susceptible and infected states and a removed state. The model is analysed to determine in terms of the parameters the necessary conditions and timescales for the onset of the epidemic, the size and duration of the epidemic and the maximum level of the infected individuals at one time. Two biologically reasonable asymptotic limits are considered, 1) small mutation rate and 2) small mutation rate and small infection rate of the bird-human form. A stochastic version of the model is presented to provide alternative estimates when these rate constants are very small to account for the stochasticity. The model can be extended to investigate the effectiveness of a range of quarantine and vaccination programmes giving quantitative estimates on the outcomes of these control measures.

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