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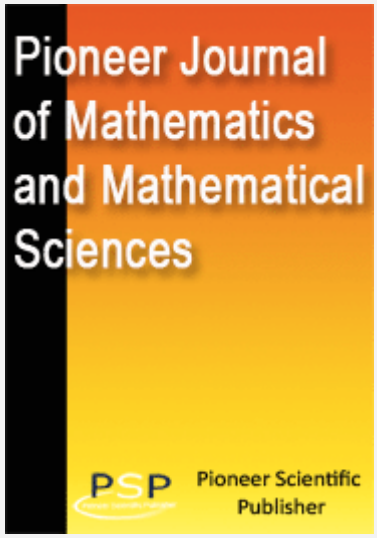


# NETWORK EPIDEMICS AND EARLY STAGE VACCINATION: THE EFFECTS OF INFECTIOUS AND VACCINATION DELAY PERIODS AND THEIR RANDOMNESS

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## Abstract

It is known that the distributions of the latent and infectious periods affect the dynamics of the spread of an infectious disease. Here we consider the SEIR epidemic model describing the spread of an infectious disease giving life-long immunity in a community whose social structure can be represented by a simple random graph having a pre-specified degree distribution. Two real time vaccination strategies, based on tracing and vaccinating the friends of infectious individuals during the early stages of an epidemic, are proposed. The first strategy considers vaccination of each friend of a detected infectious individual independently with probability ρ. The second strategy sets an upper bound on the number of friends an individual can infect before being detected. We derive both the basic reproduction number and the strategy-specific reproduction numbers and show that these reproduction numbers decrease when the variances of the infectious period and the time to detection increase. Under the assumption that detection may only occur after the latent period, the reproduction numbers are independent of the distribution of the latent period.

**Keywords and phrases:** branching approximation, coefficient of variation, degree distribution, epidemic models, social networks, vaccination strategies.