

# Vanishing protection in a vaccinated population

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In this contribution, we present a simple epidemiological SIRV (Susceptible, Infected, Recovered, Vaccinated) model designed to analyze the impact of vanishing protection on a vaccinated population. Additionally to the standard processes of infection, recovery and vaccination, a recovered individual can become susceptible again with rate  $q_1$  and a vaccinated individual can become susceptible again with rate  $q_2$ . Based on previous work [1], we focus on the study of the similarities of and the differences between the two processes, with respect to the asymptotic states (endemic or disease-free) and to transient solutions (epidemic waves).

For open systems (including birth-death processes), we distinguish between vaccination at birth and vaccination of the adult population. Finally, we discuss some recent results on the entropic aspects of the model.

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[1] E. Grella, M. Stich, A.K. Chattopadhyay, *Epidemiological impact of waning immunization on a vaccinated population*, Eur. Phys. J. B **91**, 267 (2018).