

# A generalized Reed-Frost model for the spread of NDV in a farm population

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## Abstract

In this thesis we create and analyze a model for the spread of Newcastle disease in a farm population. Our model takes the stable structure of Swedish farms into account, allowing the virus to spread in the population inside the stable and between stables. We derive the basic reproduction number  $R_0$  for the setting with only a single stable along with the next-generation matrix of which the dominant eigenvalue is the basic reproduction number for more than a single stable. With programmed simulations in R we analyze the final size of the epidemic for varying values of parameters and  $R_0$ . We draw conclusions about how various parameters affect  $R_0$  on their own and look at the effect of the free parameters on the probability that the disease never leaves a stable where it started. We find that without knowing more about the infectivity and mortality of the virus the only way that stable separation is a sufficient way to safeguard against further spread is if infected stables are unable to contact other stables and the farmer is able to quickly recognize symptoms of NDV.

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